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On the blowing of Air into Furnaces by a Fall of Water. By the late William Lewis, M. D.

[Continued from p. 16.]

EXPERIMENTS OF THE PROPORTIONAL BORES OF THE FUNNEL AND PIPE.

We have already seen, that unless the throat of the funnel is less than the pipe, the quantity of air carried down will be inconsiderable; and that by lessening it further than to a certain point, the effect is also diminished. To hit this precise point is not perhaps possible; and the point which is the most perfect proportion for one height of water, cannot be so for any other; an increase of the pressure, disposing the jet to spread more, and fill a larger bore.

It appears from some experiments already mentioned, that when the whole height of the fall of water is fifteen feet, the height of the pipe ought to be nine feet, and that of the funnel six. This being as low a fall as these kinds of machines have generally been erected for, and as high a one as is generally to be expected in this country, I made several trials for adjusting the proportions to those heights; using for the funnel, a tapering copper pipe, into the lower end of which were occasionally inserted smaller pipes, of different bores.

By trying several of these funnels we came to certain sizes, which could not be much increased or diminished, without diminishing the effect of the machine; but if there is, in this respect, any exact standard, our experiments did not discover it. There are so many circumstances, as we have already seen, which influence the effect, that it is very difficult to judge, when the differences are small, how far they depend on any particular one. When the area of the orifice of the pipe was from four to five times greater than that of the funnel,

the differences in the height of the gauge were not very considerable: the due proportions seem to lie within these bounds; and perhaps nearer to the latter than to the former; for when the funnel was only about the sixth part of the area of the pipe, the gauge stood rather higher than when it was a third part; from whence, the proportions should be as one to somewhat more than four and a half.

Experiments of dividing the stream, so as to increase its effects, and render less water sufficient.

As the effect of these kinds of machines depends on the water being spread and divided; and the air, which comes in to fill the interstices between the little streams, or drops, which compose the jet, being pushed down with velocity, by the succeeding water; I have endeavoured to divide the stream more effectually than is done in the common machines, and with little or no diminution of its velocity, by varying the form of the aperture of the funnel.

On the orifice of the funnel, I fitted a perforated tin plate, like the nose of a watering pot, but with the holes larger, and of a triangular figure; this figure was chosen on account of its great surface; water passing through a triangular aperture having about a third part more surface than through a circular one of equal area: some more holes were made round the sides, in such positions that the streams issuing from the higher holes might no where fall upon, or coincide with those from the lower ones; but that the water might be uniformly dispersed through the whole cavity of the pipe. By this division of the water it was made to fill a much larger bore than otherwise, and to produce as great an effect as the full quantity of water which the same pipe would otherwise have required; insomuch, that quantities of water which had little effect in the common way of application, were by this contrivance, made to yield a strong blast.

This method is, however, accompanied by an inconvenience, which often showed itself in the course of the experiments; and which must be more considerable, in the continued working of the machine. After it had acted vigorously for some time, its action frequently abated of a sudden; the blast from the blowing pipe grew weak, and the gauge sunk: sometimes its force increased again in a little while; but, for the most part, it continued to diminish more and more. The cause was discovered to be bits of leaves, and other like matters, which the water had carried into the funnel, and which had in part stopped up the small apertures. The remedy was obvious, letting the water pass from the reservoir through a wire sieve, whose holes were much finer than those of the funnel; and doubtless an expedient of the same kind would prove effectual for the largest machines. It is in all cases adviseable, to have the water pass through a grating before it enters the funnel, even the common large apertures being sometimes choked up, by matters which the stream brings along with it. Where scantiness of water, or want of so high a fall as is commonly required, persuade to this contrivance for procuring a more effectual division of it, and for augmenting its power, with its surface, two or three gratings, or perforated planes, with apertures of

different sizes, will be necessary; one, with very fine holes, much smaller than those of the colander; that nothing can get through the former, which can be in danger of sticking in the latter: another with larger apertures, for detaining weeds and such other matters as would soon obstruct the finer strainer.

I have tried other methods of procuring this dispersion of the water, by making the throat of the funnel of different figures, but with little success. Whether the throat was made converging or diverging, in greater or lesser degrees, there did not appear to be any material difference in the effect of the machine. I introduced into the funnel a cylindrical core, which was fixed in the middle of it, by means of pins projecting from it, so as to leave a circular aperture all around it; and this core was sometimes solid, and sometimes a pipe, which reached above the funnel, and carried down air into the middle of the jet below; but no other difference was observed in either case, but what arose from the necessary diminution of the quantity of water. It is probable, indeed, that by duly proportioning the core to the funnel, and the width of the pipe to the sheet of water, falling round the core, the effect, by the division of the stream, would be greater than an equal quantity of water would produce when falling in one column; though the increase obtainable by this method did not promise to be considerable enough to deserve the troublesome investigation of the proportions. One trial, however, depending partly on this principle, appeared of some importance to be made.

As the water-machine of St. Pierre is said to have two apertures in the bottom of the funnel, whose streams as they issue out cross one another, and are dashed into drops, I tried to answer this intention by using for the funnel a wooden trunk, with two of its sides sloping downwards so as to leave a long narrow aperture between them; in the middle of this aperture, and parallel to the inclined sides, was placed a wedge, of the same slope with the sides of the funnel, that the water might pass out in two sheets, directed towards one another.

The funnel was, at top, about eight inches square; its width at bottom, seven inches and eight-tenths, by one inch and nine-tenths. The wedge dropped into it entirely stopped the lower aperture, and had its thin edge hanging down considerably below it: slips of wood of different thicknesses fastened on the wedge occasionally, two on each side, prevented its falling down so far, and procured spaces of different widths, between it and the sides of the funnel, so that the water could be reduced at pleasure into two sheets, seven inches and eight-tenths wide; and from less than a quarter of an inch, to three-quarters of an inch thick; the partition in the middle reaching in all cases lower down than that which confined them on the sides, that they might not unite into one, upon their discharge from the throat. Along the sloping sides of the funnel were two air-pipes, of the same breadth with them, and about an inch and a half wide; so that at the bottom there were three oblong rectangular apertures; the middle one with a wedge in it for the water, and the two lateral ones for air;

the outsides were continued about seven inches and a half below these apertures, so as to form a large cavity for the water to spread in.

The funnel above the throat was somewhat more than three feet high; on the top was fitted a wooden pipe, nearly of the same width with it, and four feet eight inches high. The top of this pipe passed up through a rectangular cistern, nearly 168 inches in length, and 96 in width, and which consequently contained about fifty-seven gallons on every inch in depth. For admitting the water, two holes were made, in two opposite sides of the pipe, about ten inches high, with two sliders fitted to them, for occasionally varying their height; and, consequently, the quantity of water received. On the outside of each hole was fixed an iron plate, perforated with numerous small holes, to keep back such matters as might choke up the throat: that the holes might be sufficient to allow water enough to pass in, the strainer was made wider than the aperture in the pipe, and bent to a semi-cylindrical form.

To the bottom of the funnel, enlarged as above-mentioned, was fitted a pipe, six feet high, and in width four inches by seven and a half. The lower end of this pipe was inserted into the head of a large cask, without a bottom, which was set in a tub above three feet deep, with three supports under the lower edge of the cask, to procure a space between it and the bottom of the tub, for the water to pass freely off. About eight inches under the orifice of the pipe, a round board, for the water to fall upon, was hung by three cords, which passed up through the head of the cask, and were secured by pegs. At one side, a tin vessel, full of water, was supported in the same manner; and through a faucet, over the middle of this vessel, was inserted a glass tube, thirty-four inches long. At the other side was the blast-pipe, about three-quarters of an inch in diameter.

The machine being thus prepared, we proceeded to the trial of it, expecting that the two streams, from their strong direction towards one another, would cross, and be dashed into drops, and carry down abundance of air. But in the effect we were greatly disappointed: the blast was weak, and the gauge rose to no considerable height, whether the wedge was dropped down or raised up, so as to suffer the water to pass in lesser or greater quantity, in thin or in thick sheets; in continued trials and variations of the apertures for three or four days, the gauge was not once observed to rise so high as ten inches. A good deal of air, indeed, escaped through the junctions of the pipe, and of the air vessel; but not near enough to make up the expected quantity.

The wedge answering so ill, it was laid aside; and in its place was introduced a leaden vessel, of the same shape with the funnel's throat, and of such a size as to rest against the sides of the aperture, by its upper edge, and hang six or seven inches down in the wider part of the pipe: in the sides and bottom of this vessel were made several holes, about two-tenths of an inch in diameter. With this alteration I had the pleasure to find that though air rushed out from the joints, even more plentifully than before; yet the blast from the blowing-

pipe was strong, and the water in the gauge-pipe rose to the top, and ran over.

I tried to measure the quantity of water necessary for producing this effect, for a certain time. The reservoir being filled to the depth of fourteen inches, the gauge rose as before, and continued high for four minutes; after which it began to sink fast; the water in the reservoir having then become too low to keep the pipe full, though it continued to run for a considerable time longer. From the dimensions of the reservoir already mentioned, it will appear, that if all the water had run out in the four minutes, it would have amounted to near two hundred gallons in one minute; but at least a fourth of it remained after that period; so that the expense could not exceed a hundred and fifty gallons in a minute. We could not expect any very great accuracy in this determination, because, as the height of the water continually decreased in the reservoir, its velocity likewise decreased; so that if a due quantity run in the last minute, a superfluous quantity must have run in the first.

The leaden colander being taken out, and the whole throat left vacant for the stream, the gauge still rose to the top; but the expense of water was now more than double to what it was before.

These trials, though not carried to such a length as I could have wished, satisfied me and those who assisted at them, that much more air is to be obtained by dividing the stream by means of a colander, than by any other methods that have been tried; and that *with such a machine as is above described, a stream of a hundred and fifty gallons, at most, in a minute, is sufficient to produce a continued blast, from a pipe of three-quarters of an inch bore, of such a strength as to support a column of water of three feet or more.*

To afford as much assistance as possible to those who may be desirous of erecting machines of this kind, I shall here collect into one view the most material particulars which my experiments have discovered, with regard to the perfection of their structure; and form from them a description of such a machine as promises to be most effectual.

The bottom of the reservoir of the water should be about fourteen feet above the level of the ground; we need not be very solicitous about procuring a greater height; for though a greater would be of some advantage, yet this advantage appears to be much less considerable than has been commonly imagined. In the channel by which the water is conveyed, are to be placed gratings of different sizes, as already mentioned; and before the aperture a finer grating, which may either be a perforated iron plate, or a wire sieve, to serve as strainers for keeping back such matters as would obstruct the apertures which the water is afterwards to pass through. The stream should enter at one side, or be so managed that the water in the reservoir, or funnel, may not be agitated by it, or put into a spiral motion, which our experiments have shown to be very injurious.

In the bottom of the reservoir is to be made a round hole, for admitting the upper end of what we have hitherto called the funnel, but which may here be more conveniently a cylindrical pipe of copper or of cast-iron, five or six inches in the bore, and seven feet long.

To the end of this pipe is to be fitted a colander, about a foot long, with the holes triangular, of about half an inch on each side; and six or seven stripes from top to bottom, at equal distances, preserved without any holes, for admitting air to pass down to the lower streams. All the holes should be directed downwards, that the streams may not be forcibly projected against the sides of the pipe which is to receive them, so as to have their velocity too much diminished.

If there are six of the perforated spaces in the colander, the number of holes in each may be twenty, so that the whole number of holes will be one hundred and twenty. The side of each of the triangular holes being half an inch, the area of which will be the eighth part of a square inch; and the sum of their areas will be fifteen square inches. The quantity of water running through one aperture of such an area, at the depth of seven feet and a half under the surface, comes out, on calculation, about six hundred and twenty-two gallons in a minute; but the real quantity will doubtless be much less than this, on account of the great friction of the water, in passing through a number of small holes, and of the resistance of the air, which increases in a very high ratio, according to the increase of the velocity, and enlargement of the surface; it is in part to make up for these retardations, that the pipe is directed to be made so high. The surface of the water is here above thirteen times greater than if it passed all through one circular aperture.

Both the pipe and the colander should have a flanch, or rim, round their orifices; and be secured to one another by screws passing through the rims of both, with a plate of lead between them, to make the juncture tight, as commonly practised in joining iron pipes for water-works. This way of joining them permits the colander to be taken off and cleaned, when a diminution of the effect of the machine shows the holes to be choked up; which, however, it is apprehended will seldom happen.

As the holes will permit more water to run through than may at all times be wanted, it is proper to have some contrivance for occasionally closing a part of them. This may be effected by means of a thin copper pipe, open at both ends, as high as the colander, and of such width as just to drop into it. It will be easily conceived, that when this register is let entirely down, the lateral holes will be covered, and the water admitted only to those in the bottom of the colander; and that by raising it further and further, more and more of the lateral holes will be uncovered. The register is to be hung by a wire, to a cross bar over the reservoir, by which wire it may be raised and lowered, and a scale or divided board, may be adjusted against the upper part of the wire, for showing the height of the register, or the number of holes closed by it.

The most commodious and effectual way of admitting air to the water, appears to be that of our first experiments, viz. hanging the throat of the funnel, in this case, and the colander, within the wider receiving pipe; for by this means the air is admitted freely and uniformly all round. This last pipe should likewise be of iron or copper, twelve inches in diameter, and spread out at top to the width of

sixteen or eighteen inches, that a large space may be left round the colander; this space should reach three or four inches above the uppermost perforations of the colander, to prevent any of the water from being dashed over the top.

A pit is to be sunk in the ground, not less than six feet deep. In this is to be placed an air-vessel, made of wood, lined with lead, without a bottom, three or four feet in width, and ten or eleven high. The vessel should be supported on feet, of a proper strength, with sufficient spaces between them for the water to pass freely out; this way is preferable to the common one, of placing the lower edge of the vessel on the bottom of the pit, and cutting an aperture in the side, because the height of the aperture, is so much taken off from that of the vessel. The reservoir being fourteen feet above the ground, and the upper pipe and colander reaching down eight feet, only six feet remain below the colander; so that the air-vessel being sunk six feet in the ground, will reach nearly up to the colander; and almost the whole height of the undermost pipe will be included within the vessel. This pipe may be above nine feet long, three feet or more of it going down into the pit, which three feet are here an entire gain in the height of the fall; for the pipe, in other machines, comes at most no lower than the level of the ground, where the water runs off on the outside. This height is gained, in virtue of the compressed air in the vessel, pushing down the water below, as already shown: it may be always as great as the height to which the water is intended to rise in the gauge. At the distance of five or six inches, under the orifice of the pipe, is to be placed the concave iron plate or stone, for the water to fall on. In the top of the air-vessel is to be fixed the gauge and the blowing pipe.

Such is the general construction of the blowing machine, which promises to be particularly useful in cases where water is scarce; or where the want of a natural fall renders it necessary to raise, by very expensive means, the great quantities requisite for working the common bellows. It is presumed, that one of these machines will be sufficient for the iron forge, and for sundry other purposes, where the quantity of air is not required to be very great; *that it will be less expensive on account of the durability of its materials, and the simplicity of its structure, than any kind of bellows now in use; and, what is of principal importance, that much less water will serve for working it.* In cases, where one of the machines cannot supply air enough, as for the large iron smelting furnace, two pipes may be used, both fed by one reservoir, and entering into one air-vessel, as practised in some of the instruments described in the beginning of this article. The use of two pipes appears more eligible than enlarging the bore of one; for air cannot be so freely introduced into a large body of water, though divided by the colander, as into two smaller ones of equal quantity.

It may be observed, that the blast will be stronger in a dense state of the atmosphere than when it is more rare or expanded, a greater quantity of air being then introduced under an equal volume. If, therefore, the quantity of water has been adjusted so as to raise

the gauge to a proper height, when the air was light, it will frequently happen that the same quantity of water shall raise it higher; and consequently, if no greater height is required, that a part of the water may be saved. As the gauge of our machine discovers, by inspection, these variations in its effect, the register affords convenient means of regulating its power, and increasing or diminishing the quantity of water.

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*On the preparation and uses of the Animal Charcoal, known, usually, under the name of Ivory-black, or Bone-black, and especially on its use in refining sugar.**

For some years past, the denomination of *Animal Charcoal* has been given to that particular kind of carbonaceous matter which remains on distilling the bones of animals in close vessels, at an elevated temperature (viz. a little above a cherry-red.)

This charcoal, which may be applied to several different purposes, as hereafter mentioned, is more especially employed to remove the colouring matter combined with various substances, such as the coarse sugars obtained from the cane, or beet-roots.

The discovery of the antiputrescent and bleaching properties of charcoal in general is due to Lowitz; but many others have been engaged, since his time, in bringing to perfection the method in which he first applied it to use.

M. Kels published, in 1798, several essays, on the perfect *decolouration* of indigo, saffron, turmeric, and black sirops, by means of powdered charcoal. He announced, that the charcoal of bones would remove the colour from these substances; but he was deceived respecting its decolourating power, which he had considered to be inferior to that of common vegetable charcoal.

In the *Annales de Chimie* for 1800, is a notice by M. Scaub, of Cassel, relative to the use of vegetable charcoal in the bleaching and purifying of honey, the sugar of the beet, &c.

The first useful application of charcoal in refining raw colonial sugars was made by M. Guillon. This eminent refiner sent into the market considerable quantities of bleached sirops, which he prepared by means of the charcoal of wood, powdered. The agreeable taste of these sirops soon caused them to be preferred to the moist sugars, then used in France in great quantities. M. Guillon's example was soon generally followed, and all the sugar-refiners employed the same process.

In 1811, M. Figuier, a chemist of Montpelier, published a notice on animal charcoal; stating, that this charcoal decoloured wines and vinegars much better than vegetable charcoal. He attributed this property, unjustly, to the gelatine which he supposed to exist in the animal charcoal; for it no longer contains the least trace of gelatine, when it has been calcined.

* Translated from the *Dictionnaire Technologique* for the Technical Repository.

Lastly, in 1812, M. Charles Derosnes thought that he could usefully employ the decolouring property, which M. Figuier found to be so powerful in animal charcoal, as a substitute for the vegetable charcoal, in the manufacture and refining of sugars; and a few experiments confirmed the propriety of his application. He imparted his project to my father and myself. The large quantities of carbonaceous residuums obtained from the distillation of bones, in our manufactories of sal-ammoniac, gave us an opportunity of preparing this charcoal at a trifling expense; and we soon united our efforts with his, to substitute the animal for vegetable charcoal, in all sugar-refineries. M. Pluvinet assisted us in this new undertaking.

The mode of operating which we recommended to sugar-refiners still presented, however, some difficulties in its application on a large scale: these I found the means of removing; and very soon the new method of refining became more simple and easy; and, being classed with the common operations of the manufactory, almost wholly excluded the former ones, in all the towns of France. We shall not be surprised at this rapid success, if we observe, that every thing else remaining the same, we could obtain, by the new process, ten parts in the hundred more of crystallized sugar than in the former mode of operating; and, what was of still greater importance, the refined sugar was whiter; and all the secondary products, such as the browner lumps, the molasses, &c., had a better taste, and were more saleable.

On its preparation.—The animal charcoal is prepared from the bones procured in large cities, and particularly at Paris, where the consumption of meat is very great.* A great number of persons collect bones throughout large cities, among the refuse of other substances; and also the bones from kitchens, which are thrown into the streets. Shopkeepers, such as the dealers in marine stores for instance, buy them, and send them to the melters; who, after having extracted the fat or grease from the bones, sell them to the manufacturers of ivory-black and sal-ammoniac.† These boiled bones require to be heated in close vessels; which operation is performed by two different processes. With the bones, broken to pieces, they fill large iron cylinders placed horizontally in a furnace; which are

* According to a work published in 1821, by order of *M. le Comte de Chabrol, Préfet* of the Seine, entitled *Recherches Statistiques sur la Ville de Paris et le Département de la Seine*, &c., the consumption of meat in that city, extracted from the registers of the *Octrois*, the results of the sales at the markets, and other authentic documents, amounts, annually, on an average of ten years, to 42,716,800 kilogrammes; which nearly equals *Lavoisier's* account. If we add to it the consumption in the suburbs, and the parts adjacent to the barriers, and also the horses slaughtered, the bones of which may be also used, the total weight may be estimated at 48,000,000 kilogrammes, containing about 12,000,000 kilogrammes of bones; about two-thirds of which are lost; for there are gathered for the manufactories of sal-ammoniac and ivory-black, at the utmost, 4,000,000 kilogrammes in a humid state, which produce only about 2,000,000 kilogrammes of manufactured ivory-black.

† These persons, for their own consumption, also treat the greasy bones in a particular way, so as to obtain a good fat from them.

adapted, by means of a tube of three inches in diameter, with a long range of a refrigeratory apparatus.

The temperature is gradually raised, till the vessels become of a cherry-red heat; at which they are kept for thirty-six hours; when the charcoal is withdrawn from the cylinders, to be instantly inclosed in the extinguishing-boxes. It is sufficient, then, to leave it to cool, and to reduce it into very fine powder.* The greater part of the animal black is prepared in this manner.

The second process consists in carbonizing the bones in cast-iron pots, used in pairs, the one being inverted upon another; so that they assume nearly the form of a cylinder terminated by spherical ends. The joints are luted with loam. The cracks, caused by the contraction which the loam experiences in the fire, are sufficient for the escape of the vapourized water, the empyreumatic oil, and the gases resulting from the decomposition of the animal matters; such as hydrogen, carbonic acid, oxygen, and azote, either separate or combined, two and two, three and three, or in other varied mixtures, during the different periods of operation. The temperature of the whole soon becomes sufficiently elevated for the disengaged volatile products to be inflamed, and thus to assist the operation, by uniting with the fuel to produce heat. When the carbonization is complete, and all the volatile products are disengaged, the furnace is allowed to cool, so that a man may enter it: the brick-work door of the furnace is then broken down, and the cast-iron vessels are emptied: the bone charcoal they contained is pounded in the dry state, and is then ready for sale.

Thus, as we have before stated, the use of vegetable charcoal, in the refining of sugars, preceded, and finally led to, the application of animal charcoal to the same purpose; the strength of the latter being much more considerable, although it contains a much less proportion of pure carbon. We must therefore infer, that it possesses a particular decolouring principle, which, however, it would be a vain endeavour to describe.

The immense advantages which this animal charcoal possesses, in its application to the refining of cane-sugar, and the preparation of sugar from the beet, raised fears of not being able to obtain a sufficient supply, and a desire of finding out another article which might be substituted for it. The Society of Encouragement proposed a prize of 2000 francs for solving of the problem; and the Paris Society of Pharmacy proposed another, on the question of the mode of action of the animal black, for the purpose of throwing some light on the problem which engaged public attention. Several Memoirs, presented at the meeting of the Society of Pharmacy, were approved by a special commission. In fact, the researches of all the different competitors ended in the same theory. Two of these Memoirs were successful; that of M. Bussy and my own. I will extract what I have yet to add, from this latter Memoir; in which I am also bound

* In order to obtain more constant results, I employ for this operation, in my own manufactory, the power of a steam-engine to work the mills.

to resolve some questions, not indeed contained in the *programme*, but which appear to me to be called for by the manufacturers, to whom the animal charcoal is of the first consequence.

Without entering into a detail of the experiments therein contained, I shall present the useful results which appear to me to be demonstrated in this Memoir.*

The phosphate of lime is, in general, one of the principles found, by analysis, in the animal charcoals, (the pure carbon excepted:) but either when alone, or in double or triple combinations, it presents no other properties than those of simple carbon.

Animal charcoal acts the better, as it is more divided, and as its carbonization is the more complete; and especially when a certain degree of temperature has not been exceeded, during its carbonization. Its energy is increased, when it is freed from some of the soluble substances which generally accompany it.

The foreign soluble vegetable substances in sugar, which accompany the colouring matter, are also removed by the action of the animal charcoal, in the treatment of solutions of new sugar. This effect, doubtless, contributes to increase the quantity of crystallized sugar obtained.

The *carbon*, when freed from the substances which accompany it in animal charcoal, and particularly from the phosphate and carbonate of lime, by means of the hydrochloric acid and numerous washings, acts much more powerfully upon the colouring matter of raw sugar, than the crude animal charcoal does, in equal weights. This substance may, therefore, be considered as the active principle in animal charcoal.

If we were to calculate thus, in order to verify the exactness of these properties; namely, that ten parts of this *pure* carbon were as active as 100 parts of the crude charcoal from which it was extracted; we should find that this is not the case, but that the *pure carbon* possesses a decolouring power only three times as great as that of the crude animal charcoal. Now, as the latter contains only 0,1 of carbon, we may conclude, "that, by extracting the sub-carbonate and phosphate of lime from the animal charcoal, we sustain a real loss in its decolouring action, in the proportion of ten to three, or seven-tenths."

It appears, according to these results, that the decolouring power is not solely confined to the *carbon:* it has, nevertheless, been demonstrated, that it could not reside in any other substance. In order to explain this apparent anomaly, we may be allowed to suppose, that, without acting directly, the foreign substances in the charcoal of bones may serve as auxiliaries to the carbon, in retaining its molecules in a state of division, and thus presenting them to the colouring matters in a kind of chemical division; and other results confirm me in this opinion.

I am well convinced that all charcoals, whether from animal,

* *Théorie de l' Action du Noir Animal sur les matières colorantes, et dans ses applications à la fabrication et au raffinage du sucre.*

vegetable, or mineral substances, and however accurately they may be divided mechanically, have very little effect on colouring matters, when, after carbonization, they present *brilliant surfaces*; such as the ordinary charcoals of wood, horn, muscular flesh, sinews, leather, and, generally speaking, of all the softer parts of animals; and also those of bitumen, pit-coal, &c. The *animal charcoal from bones* also becomes less active, when, in calcining, it is mixed with any animal, vegetable, or mineral matters susceptible of being fused during the carbonization; as they cause the surfaces of the bone-charcoal itself to be covered with a kind of carbonaceous varnish, which paralyzes its decolouring action, by clogging up, or binding the molecules of the carbon closely together. An instrument which I have lately had constructed, assists me in appreciating, comparatively, the decolouring powers of the different kinds of charcoal.

It is clearly proved, therefore, that those charcoals which present *brilliant surfaces*, whatever be their origin, possess very little energy on colouring matter.

I have shown, by a great number of experiments, that the same substances which directly form brilliant charcoals may be treated so as to produce very active dull charcoals. Thus, in calcining, at a red heat, blood previously dried with pot-ash, as in the preparation of Prussian-blue, we obtain a carbonaceous residuum, which, when freed from the soluble salts it contains, possesses an extraordinary decolouring power, ten-fold greater than *ivory-black*. But, to say the truth, we have not yet been able to prepare this charcoal, so as constantly to arrive at the same perfection: I have in vain attempted it, when operating in the large. In fact, I have declared it as my opinion, that if the *ivory-black* which has been already used could be cleared from the animal and vegetable substances with which it thereby becomes mixed, it might, by a fresh carbonization, be restored to its primitive energy.*

It follows, therefore, as I have before stated, that *brilliant* charcoal does not possess a good decolouring quality, and that all the most active charcoals *have a dull appearance*. The established distinction, then, between *animal charcoal* and *vegetable charcoal*, as respects their decolouring properties, is wrong; and it would be better to distinguish them by the appellations of *dull* and *shining* charcoal.

The modifications above mentioned, which render inert-charcoals active, and *vice versa*, appear to me to prove, that the decolouring action of charcoals in general, depends on the particular state in which the carbon is found in them—a state which, where the char-

* I have pointed out various means by which I have succeeded in obtaining these results. One of them may be applicable to the Colonies: it consists in producing a fermenting action, by collecting the ivory-black-deposits into large masses, and keeping them at a high temperature (of from twenty-five to thirty degrees;) they are then washed in a large quantity of water; dried in the air; and again subjected to the action of heat. In this manner, by operating with some precautions, we obtain an ivory-black of a good quality, which may be used a second time.

coals possess very great energy, may be considered as a kind of chemical division.

In the application of *animal charcoal* and *vegetable charcoal* to the refining of sugar, we have observed some apparent anomalies, with which I have endeavoured to make myself acquainted. I have observed, that animal charcoal, but little carbonated, acts better in acid and viscous sirops; because the great proportion of ammonia which it contains, independently of the carbonate of lime, saturates the acids formed, and, by its excess, destroys their viscidity. The molasses and sirops, being more fluid, run better, and the sugar is whiter; although this charcoal may be for ordinary purposes much weaker than charcoal sufficiently carbonated.

In the manufacture of sugar in the Colonies, and of the sugar from the beet-root, a considerable quantity of lime is employed to *defecate* the juice: the excess of lime, which remains in solution in the liquid, re-acts upon the sugar during the whole time of its evaporation, and renders a great part of it uncrystallizable. In the refining process, where lime is also employed, under certain circumstances this agent is equally serviceable, in fulfilling the end desired; and is also injurious when in excess: it is therefore very important to be able to arrest its improper action in time. It would be difficult to do this by means of an acid, or an acid salt; because the least excess of either of these substances would be more dangerous than the action which we wish to prevent. Animal charcoal possesses this useful quality: it completely saturates the lime: this I have clearly proved. Thus, if we take 100 grammes of distilled water saturated with lime, and boil it for an hour with 10 grammes of the common animal charcoal; or even wash it well with boiling water, and then throw the whole on a filter; the clear liquid will not be rendered turbid by the oxalic acid, or the oxalate of ammonia—re-agents, by which we may discover the smallest possible quantity of lime in solution. No satisfactory theory has yet been given of this action; which charcoals, not containing *phosphate of lime*, have not seemed to me to produce: and this, probably, is the principal cause of their inferiority, as respects the purposes which we are now discussing.

Animal charcoal, on account of the sub-carbonate of lime it contains, may also completely remove the excess of acid in sirops; it has therefore the double property of saturating both the lime and the acids.

According to the results, above cited, of a work of Lavoisier's on the territorial riches of France; or those of a more recent statistical work, published by order of M. le Comte de Chabrol; I think we may be able to ascertain, that the quantity of bones afforded from the consumption of meat, in Paris and its environs alone, would be more than sufficient to manufacture animal-black necessary for the refining of all the sugar which we consume annually; and, in fact, that the animal-black now manufactured is more than sufficient for our refineries. I am at this moment engaged in devising the means of exporting to our Colonies the excess of this manufacture.

When the advantages which the use of animal charcoal presents,

in the preparation of raw sugar in the Colonies, shall be known, its use will doubtless become of more importance: but we may be allowed to hope, that, by employing it twice over, the quantity which we can export will be found sufficient. This induces me to add a few observations, on the secondary employment of animal charcoal, by revivifying it.

I have pointed out, in this article, a possibility of restoring to the animal-black, which had been once used, its primitive energy; but I have also remarked, that it cannot be effected with economy.* It is probable, that particular circumstances may be favourable to the application of a part of this process in the Colonies. It appears to me possible to act upon it in the following manner:—the thick black-deposits remaining upon the filters may be daily collected into one mass, and be put into a covered trough, or any other large and covered reservoir, and be allowed to ferment; which it will not be slow in doing, in consequence of the sugar, and other vegetable matters, remaining in the charcoal. When the alcoholic acid, and even the putrid fermentations, have terminated, it must then be subjected in closed cast-iron cylinders, for several hours, to a red heat. The carbonaceous powder must then be ground afresh in a horizontal mill; and thus an animal black will be obtained, very little inferior to the original black employed;—which will be productive of very great advantages; as the animal charcoal becomes extremely dear in the Colonies, in consequence of the expense of its importation.

Animal Charcoal, in an impalpable powder, may be usefully applied as *a facing* to moulds for making iron or bronze castings: I have also used it with success in the cementation of delicate pieces of iron, to convert them into steel: it forms *ivory-black*, *bone-black*, &c.: it is spread upon land, as a manure; and assists vegetation, even after being used in the refineries, &c. It is employed, not only in the preparation of sugar, but also to remove the colour of various extracts, whether siropy or saline. P.

On the preparation of the Silver-gilt Wire, used in the manufacture of Gold Lace, and for other purposes. Extracted from DR. WILLIAM LEWIS'S *Commercium Philosophico-Technicum.*

THERE is very little wire made entirely of gold; and this chiefly for one particular purpose, that of filligree work. What is commonly called gold-wire has only an exterior covering of gold, the internal part being silver. A rod of silver, above an inch thick, two feet in length, and weighing about twenty pounds, is coated with

* The *Society of Encouragement*, at its last annual sitting, voted a prize for the revivifying animal-black employed in sugar-refineries; but the process has not yet been published. At any rate, the decolouring strength of the animal-black thus revivified is extremely variable; so that the problem, by which they demand the restoration of the black to its pristine qualities, after having been once used, is not yet completely solved.

gold; and then reduced into wire, by drawing it successively through a number of holes made in metallic plates, diminishing insensibly in a regular gradation.

The purity of the gold employed for this use is a point of the utmost consequence; for on this principally depends the beauty and durability of the colour of the laces, brocades, and other commodities prepared from it; and, unhappily, there is more room for abuse here, than in gold-leaf, the extension of the metal in this form, being less affected by an addition of alloy. The boasted superiority of the French laces to the generality of those made in England, for which various causes have been falsely assigned, appears to be wholly owing to a difference in the fineness of the gold: our workmen have, of late years, had finer gold put into their hands than formerly, and the produce has been judged not inferior to that of France; nor is it to be doubted, that the English artist, acknowledged not to be wanting in manual dexterity, will, with equal or superior materials, produce an equal or superior commodity. It should seem, therefore, necessary, for the purposes of so important a manufacture, where so much depends upon the purity of the gold, not only to employ it in the purest state to which it can be brought by the usual methods of refining, but even to seek for means of purifying it to a greater degree, than any of the common processes are capable of doing.

With regard to the silver, which makes the internal body of the wire, its fineness is of less importance. I have been informed, by some experienced workmen, that there is an advantage in its being alloyed; that fine silver, on being annealed in the fire, becomes so soft, as to suffer the golden coat, in some measure, to sink into it; and that the admixture of a little copper communicates a sufficient hardness, for preventing this inconvenience. Accordingly, the French silver for gilding is said to be alloyed with five or six penny-weight, and ours with twelve penny-weight, of copper, in the pound troy. Some have thought that this over-softening of the silver might be equally prevented, by using less heat; and that fine silver, receiving a smoother surface than such as is alloyed, must show the golden covering to better advantage. How far these presumptions are well founded; or how far the manufacture is affected, by the above differences in the quantity of alloy, I cannot take upon me to determine.

The gold is employed in thick leaves, prepared on purpose for this use, which are applied all over the silver rod, and pressed down smooth with a steel burnisher. Several of the gold leaves are laid over one another, according as the gilding is required more or less thick. The smallest proportion allowed by act of parliament is 100 grains of gold to a pound, or 5760 grains of silver. The largest proportion, for the best double-gilt wire, as Dr. Halley was informed by the workmen, is 120 grains to a pound; though I am told that, of late, the proportion of gold has been increased.

The first part of the drawing process, as well as the preparation and gilding of the silver rod, is performed by the refiner, who uses plates of hardened steel, with a piece of tough iron welded on the back, to prevent the steel from breaking. In this back part, the

holes are much wider than the corresponding ones in the steel, and of a conical shape; partly, that the rod may not be scratched against the outer edge, and partly for receiving some bees'-wax, which makes the rod pass more freely, and preserves the gold from being rubbed off. The plate being properly secured, one end of the rod, made somewhat smaller than the rest, is pushed through such a hole as will admit it, and laid hold of by strong pincers called clamps, whose chaps are toothed somewhat like a file, to keep the rod from slipping out, by the violence necessary for drawing it; the handles or branches of the clamps are bent upwards, and an oval iron loop put over the curvature; so that the force which pulls them horizontally by the loop, serves, at the same time, to press them together: to the loop is fastened a rope, whose further end goes round a capstan, or upright cylinder, with cross-bars, which requires the strength of several men to turn it. The rod, thus drawn through, is well annealed, then passed in the same manner through the next hole, and the annealing and drawing repeated; less and less force sufficing, as it diminishes in thickness; when reduced to about the size of a large quill, it is delivered in coils to the wire-drawer.

The remainder of the process requires plates of a different quality; those of steel, whether in a hard or a soft state, being now found to fret the wire, or to raise a bur upon its surface, and strip off the gold. The plates for this part of the work are brought from Lyons, in France: the holes are drilled in them here. They are formed of a metallic mass, whose composition is kept a secret, but whose prevailing ingredient is plainly iron. There are two sorts of these plates; one, of considerable thickness, for the wire in its larger state; the other, only about half as thick, for the finer wire, where less force is sufficient in the drawing. There are considerable differences, also, in the quality of the metal itself, not to be distinguished by the eye, or any otherwise than by repeated trials: such of the thicker plates as are found good are valued at a high price. The Lyons plates, though brittle, have sufficient toughness to admit of the holes being beaten up, or contracted, by a few blows of a hammer; so that when any of them have been widened, by a length of wire being drawn through, they are thus reduced again to the proper dimensions for preserving the gradation: the holes, after each beating up, are opened by a long slender instrument called a *point*, made of refined steel; one end of which, to the length of about five inches, is square, and serves as a handle; the rest, about twice as long, is round, and tapered to a fine point. The first holes, being soonest gulled, or so far worn as to be unfit for bearing further reductions, the next to them, grown likewise wider, supply their places, and are themselves successively supplied by those which follow; whence, as each plate is furnished with several more of the small holes than are wanted at first, it continues to afford a complete series after a considerable number of the larger have become unserviceable. Great part of the dexterity of the workman consists in adapting the hole to the wire, that the wire may not pass so easily as not to receive sufficient extension, nor so difficultly, as to be broken in the drawing.

For determining this point with greater certainty than could be done from the mere resistance of the wire, he uses a brass plate, called *a size*, on which is measured, by means of notches, like steps, cut at one end, the increase which a certain length of wire should gain, in passing through a fresh hole; if the wire is found to stretch too much or too little, the hole is widened or contracted. As the extension is adjusted by this instrument, there are others for measuring the degree of fineness of the wire itself: slits of different widths, made in thick polished steel rings, serve as gauges for this use.

The wire-drawer's process begins with annealing the large wire received from the refiner: this is performed by placing it coiled up on some lighted charcoal, in a cylindrical cavity, called *the pit*, made for this purpose, under a chimney, about six inches deep, and throwing more burning charcoal over it; the pit having no aperture at bottom to admit the air, the fuel burns languidly, affording only sufficient heat to make the metal red-hot, without endangering its melting. Being then quenched in water, for the sake of expedition in cooling it, though the metal would, doubtless, be softened more effectually if suffered to cool leisurely, one end of it is passed through the first hole in the thick plate, and fastened to an upright wooden cylinder six or eight inches in diameter: in the top of the cylinder are fixed two staples; and through these is passed the long arm of the handle, by which the cylinder is turned on its axis by several men. In the continuation of this part of the process, called *degrossing*, the wire is frequently annealed and quenched, after every hole, or every other hole, till it is brought to about the size of the small end of a tobacco-pipe: and in this state it is cut into portions for the fine wire-drawer.

In this last part of the wire-drawing process, annealing is not needful; but it is still necessary, as before, to wax the wire afresh at every hole. Much less force being now sufficient for drawing it through the plate, a different instrument is used: a kind of wheel, or circular piece of wood, much wider than the foregoing cylinder, is placed horizontally: in its upper surface, are some small holes, at different distances from the axis; and into one or another of these, according to the force required, is occasionally inserted the point of an upright handle, whose upper end is received in a hole, made in a cross-bar above. From this, the wire is wound off upon a smaller cylinder, called a *rotchett*, placed on the spindle of a spinning-wheel; and this last cylinder being fixed on its axis, behind the plate, the wire is again drawn through upon the first; and being at length brought to the proper fineness, it is annealed, to fit it for the flatting-mill. This annealing is performed in a different manner from the foregoing ones, and with much less heat: for if the wire was now made red hot, it would wholly lose its golden colour, and become black, bluish, or white, as I have often experienced, in different parcels of gilt wire. Being wound upon a large hollow copper bobbin, the bobbin is set upright, some lighted charcoal, or small coal, placed around it, and brought gradually nearer and nearer, and some more small-coal put into the cavity of the bobbin; the wire being carefully watched, that,

as soon as it appears of the proper colour, it may be immediately removed from the heat. This is an operation of great nicety, and is generally performed by the master himself. The wire, though it in good measure retains the springiness which it had acquired in the drawing, and does not prove near so soft as it might be made by a greater heat, is, nevertheless, found to be sufficiently so, for yielding with ease, to the flatting-mill.

The flatting-mill consists of two rolls, turned in a lathe to perfect roundness, exquisitely polished, placed with their axes parallel, one over the other; set by screws, till their circumferences come almost into contact, and both made to go round by one handle: the lowermost is about ten inches in diameter; the upper, commonly little more than two, though some make it considerably larger; and indeed it would be more convenient, if made as large, or nearly so, as the lower: their width or thickness is about an inch and a quarter. The wire, unwinding from a bobbin, and passing first between the leaves of an old book, pressed by a small weight, which keeps it somewhat tight; and then through a narrow slit, in an upright piece of wood, called *a ketch*, which gives notice of any knot or doubling; is directed, by means of a small conical hole, in a piece of iron, called *a guide*, to any particular part of the width of the rolls; that, if there should be any imperfection or inequality of the surface, the wire may be kept from those parts; and that, when one part is soiled, by the passage of a length of wire, the wire may be shifted, till the whole width of the rolls is soiled, so as to require being cleaned and polished anew, with the fine powder called putty, prepared by calcining a mixture of lead and tin: the workmen value the rolls, from the number of threads they will receive, that is, from the number of places, which the wire can thus be shifted to: good rolls will receive forty threads. The wire flatted between the rolls, is wound again, as it comes through, on a bobbin, which is turned by a wheel fixed on the axis of one of the rolls; and so proportioned that the motion of the bobbin just keeps pace with that of the rolls.

[*To be continued.*]

On the Italian Wire-drawing Plates; and on Welding Cast-iron to Wrought-iron, by H. W. Reveley, Esq. *Civil Engineer; with additional observations, by* Thomas Gill, Esq.

In the preceding article, "On preparing and gilding silver wire," extracted from the late Dr. Lewis's celebrated "*Commercium Philosophico Technicum*," the author mentions, that the gilt copper rods are first drawn through holes made "in plates of *hardened steel*, with a piece of tough iron welded on their backs, to prevent the plates from breaking;" and are finished by drawing them through smaller holes, made "in plates of a different quality; those of *steel*, whether in a hard or soft state, being now found to fret the wire, or to raise a bur upon its surface, and strip off the gold. The plates for this

part of the work are brought from Lyons, in France; the holes are drilled in them here. They are formed of a *metallic mass*, whose composition is kept a secret, but whose prevailing ingredient is plainly *iron*."

We have recently been favoured by Mr. H. W. Reveley with an account of the method practised in Italy for making their plates, and which is as follows:

A piece of plate-iron is formed into a sort of shallow box or tray, its edges being bent or turned up at a right angle all round. This case is then filled with broken pieces of *cast-iron*, and heated to a welding-heat, when it is well hammered, and firmly united to the iron. The holes are then punched through it from the back, the face of it being thus formed in the *cast-iron*.

This information throws considerable light on the probable method of forming the Lyons' plates; and, indeed, we know, that during the late war, *considerable quantities of cast-iron draw-plates were made and sold in this country for Lyons' plates, and fully answered their purpose!*

Mr. Reveley informs us, that the Italian and the Lyons' wire-drawers are continually in the habit of associating together. They gave the singular name of *Acciajo Salvatico*, or *Wild Steel*, to this compound of cast and wrought-iron.

It is not the first time that we have known of this union of cast with wrought-iron, by welding. In the North of England, many years ago, it was no uncommon practice to *steel*, as they termed it, horse-shoes with pieces of cast-iron at their toes and heels, with bits of broken cast-iron plates, generally the backs of stoves or grates broken to pieces, and afterwards to harden them like steel; and they were found to wear as well, whilst the cost was much less, than if steel had been actually employed.

The working of this cast-iron and wrought-iron in Italy is always done in *charcoal fires*, which it is essential to notice.

[*Tech. Rep.*

Improvement in Drawing Iron and Steel Wire.

Accident is frequently the source of improvement in the arts, and this valuable improvement owes its origin to this cause.

The acid liquor used in pickling iron-wire during the drawing of it, requiring to be warmed, ingots of brass, lying at hand, were accordingly heated red-hot and quenched in the liquor; the consequence of this was, that a portion of the copper in the brass became dissolved in the liquor, and was precipitated upon the surface of the iron-wire pickled in it.

It was found that *the wire thus coated passed through the holes in the plates with remarkable facility*, it requiring to be annealed much less frequently than before, owing, no doubt, to the copper prevent-

ing the action of the plate upon it, so as to gall or fret it, and, in fact, *lubricating* it as it were.

We need hardly add, that this circumstance happening in the manufactory of a scientific individual, he has since constantly availed himself of the use of a weak solution of copper in iron and steel wire-drawing. The slight coat of copper is entirely got rid of in the last annealing process. [*Ib.*

Directions for bending, blowing, and cutting of Glass, for chemical and other purposes. Extracted from Chemical Manipulation. By Michael Faraday, F. R. S.

1. The art of blowing, bending, and cutting glass, is one of essential importance to the experimental chemist; but its use is not confined to him alone, there being many purposes in the arts, and in domestic economy, to which a knowledge of it is applicable. As an object of curiosity there are few things which are more attractive to persons in general, than the working in glass by the aid of the blow-pipe; and although the first attempts may be unsuccessful, the Editor knows, from his own experience, that a moderate degree of skill may be obtained by a little perseverance.

Mr. Faraday, who, in his 'Chemical Manipulation,' has furnished the student with that practical and minute information, which is obtained only by the labour of years, has devoted many pages of his work to the art in question, the whole of which we shall publish in successive numbers, commencing with

The Table Blow-pipe.

This consists of a small table, furnished beneath with a pair of double bellows, worked by the foot. A tube is connected with them, which, rising through the table, is made adjustable above by sliding or moving joints, and terminates in a jet. This jet is of course larger than that of the mouth blow-pipe, being intended to urge a stronger flame, but still it should be smooth and well formed, and its aperture round and symmetrical. It is almost always the work of the instrument maker, but when a temporary jet is required, it may be obtained, excellent of its kind, by drawing out a piece of narrow thick green glass tube in the manner before described. The lamp (always sold with the table, though separate from it) should have a burner competent to hold a bundle of twisted cotton half an inch thick and an inch wide, the top of the burner being about two or three inches from the table, that the jet may easily be adjusted to any required position. Oil is the most convenient fuel for it, tallow or dripping, perhaps, the most powerful.

After having trimmed the lamp, leaving the cotton in a compact wick, rising about one-third or half an inch above the burner, light it, and place it on the table before the jet; then sitting on a chair with one foot on the treadle, work the bellows slightly, and

arrange the jet by moving the joints of the tube, until, being horizontal, or nearly so, its extremity is a little above the cotton, and close upon, or just within, the edge of the flame. The force of the blast should be such as to gather the flame, and make it proceed in the same direction with the jet without any upward inflection of its extremity. If, for want of power in the jet of air, this be not at first attained, it should not be effected by working the foot so rapidly as to fill the bellows and drive the air out by the direct force exerted upon the treadle; but the upper board of the bellows should have weights placed upon it in such quantity as to cause pressure sufficient upon the air within, to make it flow out with the required velocity. From the natural rigidity and tension of the leather, the pressure upon the included air will be greater when the bellows is nearly filled than when almost empty, so that the force of the blast may be varied by keeping the bellows more or less full, without any alteration in the loading weight. When an impulse is required stronger than that which can be produced by the weight and tendency of the bellows to collapse, more or less force may be superadded from the foot by means of the treadle.

The pencil need not necessarily include the whole of the flame rising from the wick, but as the remaining part throws off much smoke and fuliginous matter, it is better to conduct these substances away by a small hood and chimney. Such an arrangement has also the advantage of shading the bright part of the flame from the eye, in consequence of which the progress of operations carried on in the pale part are much more readily observed. It frequently happens when the flame of the lamp is too large for the jet, that no attempts to force the whole into a clear steady cone, will succeed; but upon advancing the jet a little way into the flame, the part beyond it will be thrown forward in the greatest perfection, whilst that behind the aperture rises upright in its usual state, and almost undisturbed. It is even generally advantageous to have this superabundance of flame. The pencil of flame should be conical and steady, not ragged or broken, but ending in a blue point, passing into a pale phosphorescent halo, without any luminous or smoky part at the termination.

Bending, blowing, and cutting of glass.

2. The methods of working glass by means of the table blow-pipe, will be first described, and afterwards the best mode of supplying its deficiency, by means of the common spirit-lamp and mouth blow-pipe. The chemist's operations are generally confined to glass in the form of tube, or rod; but though thus limited, they are daily useful, and it is only by practice and the frequent performance of such manipulatory processes as those described in Section xvi. that any adequate idea of their great value and service can be obtained.

3. Supposing the operator sitting before the table, the lamp trimmed and burning, the bellows put in action by the foot, and the flame clear, pointed, and steady; it will be desirable in the first place, to consider the particular circumstances requiring his attention whilst raising the middle or the end of a piece of glass tube to a red

heat, and also whilst cooling it to its first temperature. This is the simplest case requiring instruction, and must be performed with facility and readiness, before any further steps may be taken. If the tube is to be heated in the middle, its ends may be held by the fingers of each hand, so that the hands shall be beneath them, with the palms upwards; and the arms may be rested (till by practice they have acquired steadiness) upon the edge of the table. The part to be heated is to be brought, not into the flame, but into the current of hot air which passes off in the same direction from it, and the tube is to be turned, so as to become heated all round, and also moved a little to the right and left, that the temperature of the neighbouring parts may be raised. After a few seconds, when the glass has become hot, it should be brought towards the point of the flame, and ultimately into it, being turned round all the time, and also moved laterally, though not to the same extent as before, that the heat may be generally applied. By the time that the tube (supposed to be about half an inch in diameter, and one-tenth of an inch in thickness) is within the flame, occupying a place about midway between the commencement and the end of the nearly transparent part, it should be of a bright red or yellow heat, to the width of half an inch all round, so as to be perfectly soft at that part; and the heat should gradually diminish from it on each side, towards those parts which are still but little above common temperatures.

4. The tube is brought at first into the heated air, and not into the flame, because the hasty application of heat endangers fracture. Glass suddenly heated breaks, because a part is rendered hot directly in the neighbourhood of a cold part, and expanding, tears the cold and unexpanded part asunder. But when the heat is gradually applied, it has time to diffuse itself over the neighbouring parts, so that no contiguous portions have such differences of temperature as to occasion differences of expansion greater than the glass can allow, without separation of continuity. Hence the reason why the heat is directed to be applied gradually; and hence, also, the reason why the parts near to the particular spot requiring to be heated, are also purposely raised in temperature.

5. Thin glass, being heated through more rapidly than thick, requires less precaution than the latter; sometimes but little previous warming will be necessary for it, and on other occasions it may be brought directly into the flame. Some tubes are so small and thin that it will be found impossible to break them by the most sudden application of the flame; whilst with large and thick tubes it will be found almost equally impossible to heat them without making them fly to pieces. The precaution adopted must be in proportion to the size and thickness of the tube, and by a little practice will soon be duly appreciated.

6. When the end of the tube is to be heated instead of the middle, more care is required, in consequence of the great facility with which cracks commence at a sharp edge. A heat which would cause no danger if applied to the middle of a tube, would instantly cause the extremity to fly to pieces. In such cases it is best to begin by

warming the tube an inch, or a little more, from the end, and from thence proceed slowly to the end; always keeping the temperature of the part first heated rather higher than that of the end, until the glass softens, which will be below a visible red heat in daylight; after that, the end is safe, and the highest heat may be applied there.

7. The glass must not be blackened or discoloured during the operation of heating. This is a fault that may happen from either of two circumstances, namely, the incorporation of charcoal with the glass, or the reduction of the oxide of lead in it. When glass below a red heat is brought into the bright part of the flame,* a coat of charcoal is deposited; which in many cases does not disappear as the heat rises above redness, because of the incorporation of the charcoal with the melted glass; and occasionally it even increases in quantity. Being thus brought into contact with the oxide of lead in the glass, that substance is decomposed by the carbonaceous matter, and the lead being reduced, forms another kind of stain, which mingles with the former. When the stain happens by accident, it is removed by bringing the glass to the apex of the flame, that the oxygen of the air may act upon it; and if the discolouration be superficial, it is soon reduced and disappears. But this process is often inconvenient, because during the time the charcoal is burning away, and the lead becoming oxidized, the glass, which is necessarily in a melted state, is gathering together and thickening, or is contracting into inconvenient forms.

8. If after the glass has been raised to a full heat without any stain, it be brought into the bright, or especially the smoky, part of the flame, a part of the oxide of lead is reduced, and a stain occasioned. This should be immediately rectified, and removed as before, but it is far better that it should be altogether avoided.

9. The heat produced should not be irregular or patchy, varying with every turn or motion of the glass, but uniform all round a certain length of the tube: the greater the length which by the turning and lateral motions of the tube can be thus retained at a fair uniform red heat, the greater and more efficient is the skill of the operator. To this end it will occasionally be found advantageous to incline the tube to the direction of the flame, and not to hold it directly across.

10. After having proceeded thus far successfully, the operator should vary the temperature, and obtain the power of governing it: sometimes retaining the tube at a low red-heat by carrying it out of the flame; or raising it to as high a temperature as possible, by bringing it into the flame; or by confining the greatest heat to a narrow ring, or extending it as before mentioned over a broad one.

11. By this kind of practice, a knowledge of the heating power of different parts of the flame will be acquired. It will be found greatest within the pale flame just before the point of the bright flame, and that part will also heat the greatest quantity of matter. Its power

* The brightness of the flame *depends* upon the presence of particles of charcoal ignited in it. See Sir H. Davy on flame, Quarterly Journal of Science, ii. 124.

will diminish towards the extremity, though it will still be very considerable and capable of heating a large tube. The current of air which issues from, and may be considered as a prolongation of the flame, should also be properly appreciated. It has the power of keeping glass at a visible red heat at the distance of two or three inches from the point of the flame, and is of constant use in annealing tube and tube-apparatus, both in raising and lowering its temperature.

12. Besides this examination of the flame in the direction of its length, it should also be investigated laterally, as regards the power it possesses over a piece of tube, placed directly across and through it, compared with that which it exerts when the tube is a little above or below the axis of the cone. In this manner every variation produced by approaching the glass in different directions to the hottest part of the flame, may be ascertained and fixed in the mind. The glass worker, instead of varying the temperature of his source of heat, varies the position of his material in relation to it, and thus gains command of all temperatures, up to the highest which the flame can produce. The more perfectly he knows the necessary position, and the more readily he applies his knowledge and attains the temperature required, the quicker and the better will his operations be performed.

13. Besides the difference of heat dependent upon the different parts of the flame in which the glass is placed, much depends upon the size and thickness of the tube itself. It must be a powerful flame, and well managed, that will fully heat an inch in length of the middle of a glass tube, two-thirds of an inch in diameter, and the eighth, or more, of an inch in thickness. But a tube half an inch in diameter is easily heated; and when thin, or with one of smaller size, care is actually required that it be not brought into the most powerful part of the flame, and become so overheated and soft, as to be unmanageable. Practice alone affords a perfect acquaintance with these points: the size and thickness of tube, the state of the flame itself, and its power in different parts, varying almost infinitely.

14. The softness of the glass depends upon the temperature to which it is subjected. It begins to soften and bend below a visible red heat, and when in small portions is easily brought to a semi-fluid state. The condition of the glass is judged of as much by the fingers as the eye; the feeling which it has in the hands of bending with greater or less facility, or of giving way more or less readily as the ends are pushed or pulled, is a better criterion as to the proper moment of working it, than the appearance. Glass, being a transparent substance, does not assume such striking appearances, when ignited to different degrees, as opaque bodies; and its visible red heat is far higher than the visible red heat of metal or charcoal. Hence it is, that, if the glass has become stained as above described (7.) those parts will appear red-hot long before the glass. Notwithstanding these circumstances, glass when highly heated becomes visibly ignited, and these appearances help, together with the feel, to indicate its state. When of moderate thickness, the glass, in consequence of

the oxide of lead that is in it, assumes a greenish yellow tinge when it is heated; this occurs before a red heat, and helps, with other circumstances, to indicate its state. The experimenter should make himself well acquainted with these indicative appearances.

15. When the tube is in a thoroughly heated state, the experimenter should bend it; draw it out so as to render it thinner; and press it up again to increase its thickness. Stopping one end with his finger, and applying his mouth to the other, he should also blow it out and expand it; and by introducing a smooth piece of thick iron wire into a tube heated at the end, he should observe in what manner it gives way to the pressure, and to what extent it may be moulded. He will find that the glass may be bent as soon as it yields in the hands; that it must be much hotter before it can be properly drawn out or pressed up again and thickened; and that generally, the heat must be still higher for blowing and moulding. These comparative but necessary degrees of softness should be observed and remembered, as also the variations necessary for tubes of different thicknesses; thin tube, works, generally, at lower temperatures than that which is thick.

16. The experimenter should also acquire that steadiness, yet lightness of hand, and that power of retaining the tube between the fingers, which is necessary to prevent the distortion of soft glass. When heating a tube in the middle, it is impossible, whilst all is hard, not to hold it in a straight position, and any slight irregular strain or pull does no harm. But when the heat has brought the glass into a soft state, it is by no means easy so exactly to turn the tube at both ends alike, and so lightly yet equally to hold them, that the soft part shall retain its cylindrical shape; being neither twisted, nor bent, nor elongated, nor thrust up. Again, when the end of a tube is heated for an inch or more at once, or when a tube is heated so near the end that it cannot be supported there, but must be sustained from the other end, then the soft glass will tend by its weight to bend downwards. This must be counteracted by turning round the tube in the hand, so as continually to correct the inclination; letting the weight of the soft part at one moment rectify the bend it had received the instant before. During this practice it should rather be held with the hot end inclining upwards than downwards, the latter position having the apparent effect of tending to draw the soft piece of glass, as it were, from the remainder.

In these kind of practices is included that of retaining the glass steadily in one particular part of the flame at pleasure, and not moving it by uncertain motions of the hand from place to place. Very little experience will give a moderate degree of facility in these operations, and will enable a student to make his apparatus in a form adapted for use. Every fresh trial will increase his facility of working, and render his results more perfect.

17. Work of this kind should generally be performed at, or towards the lower surface of the flame, and almost always be removed out of the flame downwards. By this arrangement the hottest part of the glass is constantly at, or towards, the top of the tube, so that it may be seen; and consequently the operations, whatever they may be, as

sealing apertures, or fastening in platina wire, are more conveniently watched. The position of the hottest part of the tube being also constant, and known, allows of an advantage in bending or forming the glass; the force necessary, being applied in the proper direction, with certainty and readiness.

18. When the glass has received the required form, it is to be cooled; this must be effected with some care. It must never be taken directly from the flame and laid on cold bodies, as it is then almost sure to crack. When thin, it is not necessary to pay much attention to the annealing, but being brought to the end of the flame or beyond it, and there allowed to fall below a red heat, it may afterwards be laid aside on a tray or across some raised body, as a fragment of tube, that the hot part may be in the air. But if the glass be large or thick, it then requires annealing; for which purpose it should be carried slowly from the hot to the cooler parts of the flame, the appearances and tints being watched, that the temperature may be very gradually lowered; and it should be kept for several minutes in the stream of hot air beyond the flame for the same purpose, being gradually carried to the less heated part of it, and ultimately entirely removed. When laid aside it is adviseable to cover the cooling glass with a fold or two of paper or cloth, to make the loss of temperature still more gradual. These precautions are the more necessary if the glass varies in thickness, as for example, at the junction of one tube with another, or at the end of a tube sealed hermetically; and they are equally indispensable with the irregularities resulting from the awkward form of a bend, the fusion of wires into glass, or other circumstances.

19. The applications of these general directions will be best understood by describing some of the more directly useful operations. One of the simplest of these is that of forming the termination of a piece of glass rod to fit it for use as a stirrer. The piece of which it is to be formed is to be cut of a proper length. For this purpose a deep mark is to be made round the rod with the edge of a sharp three-square file, and being then grasped by the two hands placed one on each side of the mark, force is to be applied in a manner similar to that which is adopted in breaking a stick in two, except that in addition the hands are to pull slightly in opposite directions. If the separation be not readily effected, the file-mark must be deepened. Tubes are cut in a similar manner; such as are small, without difficulty or accident; larger ones with a little more care.

20. When separated by the file, the end of the rod is flat and the edges are sharp. Being heated carefully (5,) because of its thickness, beginning at a little distance from the extremity, it will be found that as soon as the glass has attained a visible heat at the end, the sharp angle at the edge will disappear, yielding to the cohesive force of the particles of glass, which will cause the end to assume a form more or less approaching to roundness. This effect being attained, the rod is to be annealed for a short time, cooled carefully, and is then ready for use. If a conical termination be required, then, when the end of the rod is hot and soft, the extremity of a fragment of glass

tube should be heated and pressed against it, and will adhere. The rod should then be moved a little, so that the greatest heat may be given at a tenth or twelfth of an inch from the end, and then by withdrawing the fragment, which serves as a handle, the end of the rod will be drawn away with it, leaving the termination of a conical form. When this is obtained, the tail of glass may be separated from what is to be the blunt apex of the cone, by bringing the point of the flame upon it, which causes the thin thread to fuse, separate, and run together. By retaining the end of the rod in the hot flame, the extremity will become more and more rounded; but when the desired form is acquired, the temperature must be lowered and the glass cooled as before described.

[TO BE CONTINUED.]

Prognostics of the Weather.

[Abridged from FORSTER'S *Encyclopædia of Natural Phenomena.**]

Aches and Pains in the body of various kinds frequently forbode rain. Persons, for example, subject to rheumatism, feel more pain in the affected limb or part of the body before a change of weather, particularly when fair is to be exchanged for wet. Old carious teeth are also troublesome; and pains in the face, ears, and gums, are sometimes experienced. Limbs once broken also ache at the place of their union, and various other aches and pains too various and trifling to be specified, have been, from time immemorial, found to be signs of changes of the weather.

Animals, by some peculiar sensibility to electrical, or other atmospheric influence, often indicate changes of the weather by their peculiar motions and habits.

Ants.—A universal bustle and activity observed in ant-hills may be generally regarded as a sign of rain. The ants frequently appear all in motion together, and carry their eggs about from place to place.

Asses.—When asses bray more than ordinary, particularly if they shake their ears as if uneasy, it is said to predict rain, and particularly showers. I have noticed that, in showery weather, a donkey confined in a yard near the house, has brayed before every shower, and generally some minutes before the rain has fallen, as if some electrical influence, produced by the concentrating power of the approaching rain-cloud, caused a tickling in the windpipe of the animal, just before the shower came up. Whatever this electric state of the

* The writer of these Prognostics, has distinguished himself by his researches on atmospheric phenomena, a subject upon which we are, it is believed, more profoundly ignorant than upon any other which has received equal attention. The scraps which are here collected and detailed, by a gentleman of science, may be adduced as a proof of the truth of this opinion. It will be seen that many of them apply particularly to Great Britain, whilst the greater number are more general. They are presented less for their utility, than as a proof of the extent, or rather of the meagreness of our information upon the subject. EDITOR

air preceding a shower may be, it seems to be the same that causes in other animals some peculiar sensations, which makes the peacock squall, the pintado call "comeback," and which creates a variety of prognosticative motions in the different species of the animal kingdom.

Bats flitting about late in the evening in spring and autumn, at which seasons they are most commonly seen, foretell a fine day on the morrow, as do dorbeetles, and some other insects. On the contrary, when bats return soon to their hiding places, and send forth loud cries, bad weather may be expected.

Barometer.—A separate article upon this instrument will hereafter be given.

Balloons have been made use of to ascertain the direction of upper currents of air; and as their currents by degrees get lower, and support the current blowing near the earth's surface, we may often, by means of small air-balloons, foretell what will be the direction of the breeze at the next change of wind.

Berries in the hedges often forebode a hard winter, and severe weather frequently occurs in seasons when they are particularly plentiful on the Maybush and Blackthorn. This rule is not, however, without its exceptions.

Beetles flying about late in an evening often foretell a fine day on the morrow.

Blue sky.—When there is a piece of blue sky seen in a rainy day big enough, as the proverb says, "to make a Dutchman a pair of breeches," we shall probably have a fine afternoon.

Bones which have once been broken, and are re-united, are apt to ache before rain at the place of their re-union. See *Aches and Pains.*

Butterflies, when they appear early, are sometimes forerunners of fine weather. The first sort which appears in spring is the sulphur butterfly, *Papilio sulphurea præcox*, whose wings are of a pale greenish yellow. These come in March if the weather be fine and warm. The next sort are the tortoiseshell butterflies, early in April. And in May comes the common white or cabbage butterflies. Moths and sphinxes are also signs of fine weather, when they are common in an evening.

Calm.—A dead calm often precedes a violent gale; and sometimes the calmest and clearest mornings, in certain seasons, are followed by a blowing showery day. Calms are forerunners of the hurricanes of the West Indies and other tropical climes.

Candles, as well as lamps, often afford good prognostics of weather. When the flames of candles flare and snap, or burn with an unsteady or dim light, rain, and frequently wind also, are found to follow. The excresences from the wicks, called funguses, also denote rain and wind. The curious forms assumed by the excrescent wicks of candles has led to many superstitions.

Cats are said, when they wash their faces, or when they seem sleepy and dull, to foretell rain. The same is said of them when they appear irritable and restless, and play with their tails.

Cattle, when they gambol about in their pastures more than ordinary, foreshow rain, and in general a change of weather.

Chickens, when they pick up small stones and pebbles, and are more noisy than usual, afford, according to Aratus, a sign of rain.

Cherryclacks offer admonitions of the existence and nature of the gales and breezes by night. In the cherry season of July, the noise of these scare-birds is often troublesome. There is no doubt that a whistler, to scream by the wind, might be so constructed as to point out the fluctuating strength of the blowing gale.

Chilliness, and a sensation of cold greater than the indication of temperature by the thermometer, leads us to expect, often forebodes rain, as it shows that there is already an increased moisture in the air, which experience has shown to be referrible to its decomposition and the first formation of cloud.

Cirrostratus, or wanecloud, whenever it prevails, usually forebodes rain, snow, or hail; but there are, nevertheless, some nice distinctions to be made, and which a discriminating meteorologist may soon learn to make.

Cirrocumulus, or Sondercloud, is a congeries of small roundish little clouds in close horizontal apposition. The cirrocumulus is not always uniform in its appearance; it varies in the size and rotundity of its constituent nubiculæ, and in their closer or more distant arrangement. It is frequent in summer, and often forms very beautiful skies; at all times of the year it may be seen, in the intervals of showers, and before an increase of temperature, of which its prevalence is a pretty certain prognostic. Before thunderstorms a very dense sphere of this cloud may be noticed, whose nubiculæ are close, compact, and very round, and indicate a high electrical change.

Cirrus, or Curlcloud.—When, after much fine weather, this cloud first appears like a white line pencilled along on the azure sky, we may generally reckon on a change; and if the cloud increases, and others are added to it laterally, or if it change to the wanecloud, rain will probably follow before long. The tufts of cirrus, called mares' tails, are known to be a sign of wind, which has frequently been found to blow from the quarter to which these curlclouds have previously pointed.

Clouds of any sort, when they increase much, portend rain, particularly at eventide; when they are very red they often foreshow wind; when they form a dappled gray sky, with north wind, fair weather; when they rapidly form and evaporate, variable weather. Clouds fretted and spotted, covering the sky after fine weather, or wavy like the undulation of the sea, forebode rain.—See *Stratus*, *Cirrus*, &c.

Colours of various kinds in the sky and clouds, are tokens severally of different phenomena. Much red always forebodes wind and rain, particularly in the morning; in the evening it sometimes indicates a fine day, particularly if the morning be gray. A greenish colour of the sky near to the horizon, often shows that we may expect more wet weather. The most beautiful and varied tints are seen in autumn, and in that season the purple of the falling haze is often

a sign of a continuation of fine weather. When the clouds become more coloured than ordinary, and particularly when red prevails, it sometimes indicates an east wind.

Cold and Heat.—The coldest weather, on an average, happens in the middle of January, and the hottest in the middle of July.

The nearer approach of small birds to the windows of our habitations usually forebodes cold weather.

Cocks, when they crow at unwonted hours, often foretell a change of weather. We have often noticed this before rain. But this is by no means so certain a sign as many others, because at particular seasons, and in particular kinds of weather, cocks habitually crow all day. During the calm, still, dry, dark, and warm weather sometimes occurring in the winter months, and which may be called the halcyon days of our climate, cocks keep a constant crowing all night and day. There appear to be three principal cock-crowings in ordinary weather, namely, about midnight or soon after, about three in the morning, and at daybreak; the latter is never omitted. We have noticed, however, that when cocks crow all day, in summer particularly, a change to rain has frequently followed.* Cocks are said to clap their wings in an unusual manner before rain, and hens to rub in the dust and seem very uneasy.

Coronas round the sun or moon portend rain. Coloured crowns of light, and compounded halos, are more sure signs of a fall. See *Halo*.

Cream and Milk, when they turn sour in the night, often indicate thereby that thunderstorms are about, and will probably shortly take place. The effect is referrible to the electricity of the air at the time.

Cranes.—The high flight of cranes in silence indicates fine weather.

Crows utter a peculiar cry before rain, different from their usual voice.

Currents of Air change their course frequently in the higher regions of the air first, and are afterwards continued to the earth's surface; hence we can often foresee a change of the wind by observing the way in which the clouds above move. Both the strength of a coming gale, and the point of the compass from which it will blow, may usually be foreseen some time beforehand by noticing the velocity and direction of the clouds floating along in the upper currents, or by means of balloons.

Cumulus, or Stackencloud, is that large and irregular hemispherical kind of cloud which, in fair weather, usually forms in the day and subsides in the evening. These clouds, when they are very irregular in their shapes, when they are full of protuberances and fleeces, or when their fleeces curl inwards as they pass along in the wind, indicate rainy or showery weather. Their increase, instead of vanishing, at eventide, also portends the same thing, as does their change into twainclouds.

Cumulostratus, or twaincloud, compared with cumulus, which it

* See *Perennial Calendar;* also *Researches about Atmospheric Phenomena*, by T. Forster.

resembles, is more dense, and overhangs its base in uneven or rugged folds; a pre-existing cirrus, cirrocumulus, or cirrostratus, or one perhaps immediately formed for the occasion, alights on its summit, and inosculates. Many of these cirrostrati are sometimes seen attached to the cumulostratus, and sometimes to intersect it. Cumulostrati frequently remain in this state for a long time, and constitute very picturesque skies. At other times the processes are more rapid. The cirri, or cirrostrati, are soon lost in the cumulostratus, which increases in density, and soon becomes the nimbus described in its proper place. See *Nimbus*.

The cumulostratus is one of the stages in the process by which rain is ultimately effected, of which it may therefore be regarded as a prognostic. In Switzerland, Wales, Spain, and other mountainous countries, it may be confounded at a distance, in its early stages, with distant mountains.

Dead Nettles afford a sign of a mild season when they come in winter in abundance.

Dolphins, as well as *Porpoises*, when they come about a ship, and sport and gambol on the surface of the water, betoken a storm; hence they are regarded as unlucky omens for sailors.

Dogs, before rain, grow sleepy and dull, and lay drowsily before the fire, and are not easily aroused. They also often eat grass, which indicates that their stomachs, like ours, are apt to be disturbed before change of weather. It is also said to be a sign of change of weather when dogs howl and bark much in the night; they certainly do this much at the full moon, which has given rise to the saying relative to the *Dogs that bay at the moon*. Dogs also dig in the earth with their feet before rain, and often make deep holes in the ground.

Dreams of a hurrying and frightful nature, also incubus, and other symptoms of oppressed and imperfect sleep, are frequent indications that the weather is changed or about to change. Many persons experience these nocturnal symptoms on a change of wind, particularly when it becomes east. In all these cases the effect seems to be produced immediately on the nervous system, and through it on the stomach, so that the stomach shall again re-act on the sensorium. The symptoms are enhanced by a full stomach and other sources of indigestion. See *Wind*, also *East Wind*.

Drains and sespools smell stronger than usual before rain.

Drowsiness and heavy sleep, both in men and animals, often forebodes a heavy fall of rain or snow.

Ducks.—The loud and clamorous quackling of ducks, geese, and other water-fowl, is a sign of rain. It is also a sign of rain when they wash themselves, and flutter about in the water more than usual. The above prognostics apply to various other species of water-birds.

Ears, when there is a tingling noise, or what is called a singing in them, afford thereby a sign of a change of weather, not simply of rain, as has been said, but of barometrical pressure in general. The sudden increase of pressure, like the descent from high mountains, or from balloons, causes in many persons a temporary deafness and

roaring in the ears. A sudden fall of the barometer affects also the ears, but in a different manner, like mounting a high hill.

East Wind is frequently made known to nervous people in the night by imperfect sleep, headache, and hurrying dreams. It is remarkable that good astronomical observations cannot be made when the wind is east. And frequently, when the celestial objects seem to wave and move about in the field of the telescope, an east wind is found to follow, for it has already begun above in the higher regions of the air.

Eclipse Weather is a popular term in the south of England for the weather following an eclipse of the sun or moon, and it is vulgarly esteemed tempestuous, and not to be depended upon by the husbandman.

Epidemics are disorders of health brought on by atmospherical influence; and modern discoveries have shown how much most prevailing diseases partake of an epidemical nature. Scarlet fever, typhus, the plague, and indeed most diseases of this sort, are now considered epidemical. It would, perhaps, be productive of useful results, if physicians of extensive practice would make accurate meteorological registers during the prevalence of any epidemic or contagious disorders: such as the influenza, which, a few years ago, took a range of some miles round London, but was also prevalent in other parts of the country.

Epizootie is a name for epidemic disorders occurring among animals, of which we have many and various instances on record. The state of the electrometer and other atmospherical instruments, should be carefully examined during the prevalence of such pestilences.

Feathers, pieces of flue, or dry leaves, playing about on the surface of ponds and other waters, as if agitated by light and varying eddies of wind, often forebode rain.

Fieldfares, when they arrive early, and in great abundance, in autumn, foreshow a hard winter, which has probably set in, in the regions from which they have come. They usually come in November.

Fishes, when they bite more readily, and gambol near the surface of the streams or ponds, foreshow rain.

Fire.—The brightness and heat of the fire in winter often indicates frost and clear weather, as does the lodgment of the moisture on the windows; for it demonstrates a cold atmosphere abroad. When the fire burns dull, damp weather and non-electric rain often follow: it is said that the air on these occasions has less of oxygen. The real cause, however, is unknown.

Flowers are many of them excellent indicators of the approaching weather by their opening and shutting, and other motions. See *Pimpernel*, &c.

Fleeces, and Mares' Tails, as they are called, seen in the sky, are signs of rain and wind. By fleeces are meant those clouds which look like fleeces of wool. Mares' Tails are the comoid curl-clouds called Cirri: their prevalence forebodes wind. They look sometimes like distended locks of hair.

Flies, and various sorts of volatile insects, become more troublesome, and sting and bite more than usual before, as well as in the intervals of rainy weather, particularly in autumn, when they are very numerous, and often become a great nuisance. This observation applies to several sorts of flies. The horse-flies likewise, of all sorts, are more troublesome before the fall of rain, and particularly when the weather is warm.

Forests.—The hollow sound of forests, while the wind is roaring among the woods, is a sign of rain and of storms.

Frogs, by their clamorous croaking, indicate rainy weather; as does likewise their coming abroad in great numbers of an evening: but this last sign applies more obviously to toads. Abundance of yellow frogs are accounted a good sign in a hayfield, probably as indicating fine weather.

Fungi.—In the damp weather of autumn the fungus tribe become very numerous, and often are the first phenomena which remind us of the decline of summer, and the approach of a cooler season.

Gales of Wind are foretold by a sudden fall of the mercury in the barometer, or the appearance of wane-clouds and of curl-clouds, and by many of the signs of rain. Varying gales and changing breezes often indicate a change of weather from fair to wet. The most tremendous gales and storms have been foretold by the settling of the stormy petrels under the wake of a ship.

Gallinaceous Poultry in general appear uneasy, and rub in the dust, before rain.

Geese washing, or taking wing with a clamorous noise, and flying to the water, portend rain. When wild geese are observed to migrate to the southward or westward in greater numbers than usual in autumn or winter, they are said to indicate hard weather: and in general the early appearance of flocks of these and other wild fowls in the south, foreshow a severe winter.

Gnats afford several indications. When they fly in a vortex in the beams of the setting sun, they forebode fair weather: when they frisk about more widely in the open air at eventide, they foreshow heat; and when they assemble under trees, and bite more than usual, they indicate rain.

Gossamer, as it is called, being the fine web of a certain species of spiders, floating in the air in abundance, and lodging on the trees, or the rigging of ships, and on other objects, affords a sign of fine settled weather in autumn, as does the much covering of the ground and herbage by the woof of the spiders in general. See *Spider*.

Hail, Snow, and Sleet, have but few appropriate signs. In general, the clouds which are destined to pour the cool hail-showers of a March or April day, have more defined edges and a different sort of appearance from those clouds which eventually lead to rain. There is also a peculiar dark brownish purple colour in some of the large twain-clouds which precede the vernal showers of snow and hail.

Halo.—When this phenomenon is observed round the sun or moon, it indicates the presence of the wane-cloud, and shows that hail, snow, or rain, according to the season, will soon follow. Coloured or dou-

ble haloes are still more certain indications of rain, and often of wind also. When mock suns or mock moons, bands of light, and other unusual phenomena attend haloes, a peculiar condition of the atmosphere is indicated. The proper *halo*, or luminous ring, is distinguished from the *corona* or luminous disk, which is sometimes a forerunner of rain also, but is a thing of more frequent occurrence. When haloes are very red, wind almost always follows.

Headaches often foretell a change of weather in persons subject to such complaints. There is also some obscure change of weather near to the periods of new and full moon, which causes a certain ephemeral headache, that begins usually in the morning, gets worse about two o'clock, and subsides in the evening, attended with an irritated stomach; it much resembles the ordinary bilious headache from repletion, but differs from that which follows immediately on a certain sort of indigestion. Indeed, most periodical disorders seem to be connected with some atmospheric changes. And it is very remarkable, that they should so often have their worst paroxysms, and the crisis of their terms, about the time of the conjunction and the opposition of the moon.

Hogs, when they shake the stalks of grain and spoil them, often indicate rain; also when they rub in the dust, the same or some similar phenomenon may be expected. When they run squeaking about, and throw up their heads with a peculiar jerk, windy weather is about to commence: hence the Wiltshire proverb, that "pigs can see the wind."

Horses, as well as some other domestic animals, foretell the coming of rain by starting more than ordinary, and appearing in other respects restless and uneasy on the road. It has been questioned whether those animals do not manifest also some periodical irritability, like that which influences mankind. Possibly the eyes of certain horses, like those of certain persons, may be attended with *muscæ volitantes*, or other imperfections of sight, which render their perceptions of objects less perfect before rain; they may also become more generally irritable. The fact, however, has frequently come under our observation.

Hydrometers are intended to indicate when the air is moist, or dry; and hence become prognostics of rain, which often follows a general dampness of the air.

Incubus, or nightmare, though it commonly comes of a loaded stomach, will, nevertheless, often occur on the occasion of a change of weather in the night, which seems to produce the effect by disturbing the digestive organs. The same observation holds good with regard to those frightful and impressive dreams which some persons have in particular kinds of weather, and about the period of change. An east wind beginning to blow in the night will often cause them; and sometimes the same effect is produced by that state of the atmosphere which immediately precedes a large fall of snow; though the latter phenomenon more often produces dulness and languor of the whole animal system of the body.

Jackdaws are said to be more than usually clamorous before rain. These birds frequent the flocks of rooks, and with them go out to feed, as if they were aware of the superior sagacity of the rook in finding out the most productive pasture, and had learnt to avail themselves of it. Starlings sometimes do the same. Sometimes before a change of weather, the daws make a great noise in the chimneys wherein they build, and the sound coming down the flue is distinctly heard in the chamber.

Kites.—The birds so called, *Falcones Milvi*, soaring very high in the air, denote fair weather, according to many authors. The same is observed of ravens—*Corvi Coraces.*

[TO BE CONTINUED.]

FRANKLIN INSTITUTE.

The eighteenth Quarterly Report of the Board of Managers of the Franklin Institute.

The Board of Managers of the Franklin Institute, present to the General Meeting, the eighteenth Quarterly Report of their transactions during the term which has elapsed. No subject of immediate or peculiar interest has occupied the attention of the Board since their last report; the concerns of the institution have been duly administered, and are believed to be in as prosperous and flourishing a condition as at any period since the organization of the society. The Board are enabled at this time to state, that the Actuary has entered upon the discharge of the various duties devolving upon him, and from his exertions the Board anticipate the most beneficial results. Since the last quarterly report, the committee of premiums have published their list of premiums to be awarded to competitors at the annual exhibition in October next, together with an address to the manufacturers of the United States. These have been extensively circulated, and it is confidently expected will produce the effect contemplated. The importance and value of the annual exhibitions of the Institute, to the mechanics and manufacturers of the United States, and to the interests of the Institute, is no longer doubtful, the success of former years abundantly verifies and establishes the fact, and encourages us to hope that the exhibition in October, 1828, will be equal in all respects to those of former years. The Board, therefore, call with confidence upon the members of the Institute, to aid them in carrying into effect an object of such vital importance to the interests of the institution, and of such manifest utility to the mechanics and manufacturers of the union. The subject of the location of the High School, has occupied the attention of the Board, and is now referred to the committee of instruction. The Board, therefore, deem it inexpedient at present, to make any report upon a subject, on which there exists a diversity of opinion, more especially as it is a subject of deep interest, not only to the Institute, but to the community at large.

The High School under the control of its present able and efficient Principal, Mr. W. R. Johnson, has been gradually rising to such a state of improvement, as is calculated to elevate the standard of classical learning in our community.

The Franklin Journal, under the new arrangement, has been regularly and punctually issued, and its general concerns promptly and faithfully attended to by the Actuary of the Institute, under the direction and supervision of the committee of publication. The Board are happy to announce that since it has been published under the auspices of the Institute, there has been a considerable increase of subscribers, and that it may be considered in a prosperous condition.

The Board regret to state that there exists a great degree of negligence on the part of the members, in the payment of their annual contributions; they hope the mere mention of the evil will be sufficient to remedy it. All which is respectfully submitted by

Samuel J. Robbins, *Chairman.*

On the Combination of a Practical with a Liberal course of Education. By W. R. Johnson, *Principal of the High School of the Franklin Institute.*

No. II.

The *principles* which ought to serve as the basis of a practical, republican system of education, combining useful with liberal pursuits, have already been stated. Before proceeding to give an account of the school in the establishment and management of which these principles have been *exemplified*, it may not be improper briefly to exhibit the views and purposes of the institution, of which this school is a department.

The society bearing the name of the "Franklin Institute," was established "for the purpose of promoting the mechanic arts, and of improving the *condition*, *character*, and *prospects* of the industrious class of society by whom they are exercised."

The first attempt to establish a society for this purpose was made in November, 1822, but without success. In December, 1823, a meeting of a few gentlemen was held, and in February, 1824, a *public* meeting was called for the same object. At the *latter*, the constitution was adopted. The first step taken by the society, towards accomplishing its purposes, was the establishment of lectures. These were commenced in April, subsequent to the organization of the society, were miscellaneous in their subjects, and were, at first, voluntary and gratuitous. During the winter of 1824, regular professors of natural philosophy, of chemistry, and of architecture, delivered courses of lectures on their respective subjects. A school for drawing, and another for mathematics, were opened for two quarters during the same season. In November, 1825, the means of instruction were still further increased, by the addition of a course of lectures on natural history.

Such were the advantages for instruction afforded by the Franklin Institute, previously to the 1st of January, 1826, at which time the Franklin Journal was established. The value of this vehicle of information to the adult mechanic, is sufficiently obvious, and the extensive circulation which it has attained, evinces that its importance is felt and acknowledged. So far as the instruction of *men* was to be effected, the Institute had not left scarcely any thing to be desired; but the "*condition, character*, and *prospects*" of the industrious classes of society, must be still far from enviable, if they were left without the means of accomplishing what is dearest to every intelligent parent's heart, the early and thorough education of their children. This end can be but partially and imperfectly attained by lectures. The latter may, in certain branches, be rendered highly useful as *subsidiaries*, but as *substitutes* for lessons, for study, recitations, examinations, and that system of responsibilities by which the talents of the teacher are made to act on the mind of the pupil, they are nearly powerless. Aware of this fact, and sensible of the paramount importance of youthful education, some of the leading members of the Institute early expressed a desire, that a school should be established for imparting instruction in the various branches of an elementary and useful education. The execution of this design was unavoidably delayed longer than that of the other plans of instruction, partly by the want of proper accommodations, and partly by the necessity of more maturely digesting the details of the system. On the completion of the Society's Hall in the summer of 1826, the former of these obstacles was removed, and the timely exertions of the committee of instruction, surmounted the latter. A few hundred dollars were collected by subscription, to provide the necessary furniture, and the school went into operation on the 4th of September, 1826.

It may be proper here to remark, that in addition to its influence in improving the "condition and prospects" of the industrious classes of society, by its lectures, its Journal, and its schools, the Institute has, since 1824, held annual exhibitions of manufactures, to which the citizens of the United States have been invited to send the products of their skill and ingenuity, and have been severally rewarded according to the decision of able and impartial tribunals. All these objects have been prosecuted simultaneously, and without any improper interference of one with another. The mathematical school was the least numerously attended; and since the establishment of the High School, its purposes are so fully answered there, that its continuance has not been deemed necessary.

Though avowedly established for the promotion of certain interests, this society is by no means narrow and exclusive in its spirit. It does not consist entirely of mechanics. Many citizens in various walks of life, have enrolled themselves among its members, from a thorough conviction of its usefulness, and from a hearty concurrence in its design of promoting the diffusion of useful knowledge, and the advancement of the mechanic arts.

Among the subscribers to the Journal, and to the courses of lec-

tures, no less than on the registers of the schools, will be found the names of many of our most wealthy and respectable citizens. The large and liberal views of the philosopher whose name the society has adopted, are happily exemplified, both in the nature of its exertions, and in the spirit with which they are prosecuted. Franklin never forgot the intellectual and moral part of human nature, while pursuing those studies which pertain to the physical world. The friend, alike of learning, of liberty, and of the arts, he endeavoured to bring into harmonious intercourse the different orders of society, and he doubtless felt that the most effectual mode of attaining his purpose, was to unite their efforts during the period of early education. Hence his zeal in the cause of *public* institutions for education. Hence his donations for the bestowment of premiums on meritorious scholars; and hence his exertions for the formation of literary societies among the young, to facilitate the interchange of thought, and the early development of merit, in every rank.

Under those happy political institutions which Franklin and his compatriots have transmitted to the present generation, it is in vain to think of limiting the ambition of youth to those precise objects which their fathers have pursued. The vigorous mind and elastic spirits of the young *American*, are constantly prompting him to new enterprises, to fresh pursuits, and to higher objects of ambition. The character of the society is in accordance with this spirit of the American community.

It may readily be inferred from the slight sketch above given, of the Franklin Institute, how far its operations have tended to promote the true interests of society; and from the following delineation of the course of study pursued in the High School department, an opinion may be formed respecting its adaptation to advance the same interests, to forward the general purposes of the Institute, and to realize the wishes of Franklin, and other patrons of learning and the useful arts.

The annual payment of *three* dollars is the only pecuniary consideration required to constitute a member of the society, with the right of voting at elections, and of attending all its public lectures, and exhibitions of manufactures.

Apprentices and other lads are allowed to attend all the lectures of a season, by the payment of *one* dollar each. Tickets for ladies are issued at the price of *two* dollars each.

The annual subscription to the Journal is *five* dollars.

The fee for instruction in the drawing school is *four* dollars per quarter.

In the High School the price for all branches is *seven* dollars per quarter.

The above charges have hitherto been found adequate to obtain distinguished talents for the service of the society, and should the public continue duly to appreciate and reward the efforts which are here made to render knowledge accessible to all classes, little doubt can be entertained that the same talents may still be retained for similar purposes.

FIRST YEAR.

FIRST QUARTER.	DAILY EXERCISES.	WEEKLY EXERCISES.
REMARKS. The academical year commences on the first Monday in September, and continues twelve weeks. The second quarter commences immediately after the close of the first, and continues for the same length of time, and so on through the year.	1. Arithmetic. *Colburn's Sequel.* 2. Geography, with the use of Maps. *Worcester.* 3. Writing from dictation, defining the words, and analyzing the sentences written. *Murray's Grammar and Exercises. Walker's Dictionary.* 4. Greek Grammar and Delectus. *Valpy.* 5. Latin Grammar. *Adams, Gould's edition.* 6. French. *Porney's Syllabaire, and Perrin's Fables.* 7. Linear drawing. *Fowle.*	1. Elocution. *American First Class Book.* 2. Pronunciation of French. *Fables.* 3. Exercises in oral composition.
SECOND QUARTER. The hours of attendance are from 9 till 12, in winter, and from 8 till 11, in summer, for the forenoon; and from 2 till 5, in the afternoon. On Wednesdays and Saturdays but 4 hours are employed.	1. Arithmetic, (continued.) *Colburn.* 2. Geography, (continued.) *Worcester.* 3. Correction and analysis of sentences containing false syntax. *Murray's Exercises.* 4. Greek Grammar, and Greek Delectus, (continued.) 5. Latin Grammar, and *Jacobs'* Latin Reader. 6. French. *Wahnstrocht's Grammar. Fables.* 7. Drawing *mechanical implements* in outline.	1. Elocution, (continued.) *Class Book.* 2. French pronunciation. 3. Oral composition.
THIRD QUARTER. A semi-annual examination is held at the end of the second quarter. All scholars are required to attend the examinations.	1. Arithmetic, (continued.) 2. Geography, (continued.) 3. Exercises in correcting false punctuation. *Murray.* 4. Greek Reader. *Jacobs'* Grammar, (continued.) 5. Latin Reader and Grammar, (continued.) 6. Telemachus. *Bolmar's edition.* 7. Drawing, (continued.)	1. Elocution. *Class Book.* 2. Stenography. *Gould.* 3. Composition from memory, *descriptive pieces.* 4. French pronunciation.
FOURTH QUARTER. The year closes with the annual examination, about the first of August. During that month the school is closed, no charges are made, and no instruction is given. The other holidays are New Year's, 22nd of February, three days at Easter, 1st of May, 4th of July, and from Christmas till the Monday following.	1. Algebra. *Colburn.* 2. Ancient Geography. *Worcester's Atlas.* 3. English Prosody. Exercises in Poetry, written from dictation. *Milton.* 4. Greek Reader, (continued.) 5. Latin Reader, second part. *Jacobs.* 6. Telemachus, (continued.) French phrases. *Hentz.* 7. Spanish. *Josse's Grammar.* 8. Drawing of Maps.	1. Elocution. *Class Book.* 2. Stenography. 3. Compositions, (continued,) *narrative pieces.* 4. Spanish pronunciation.

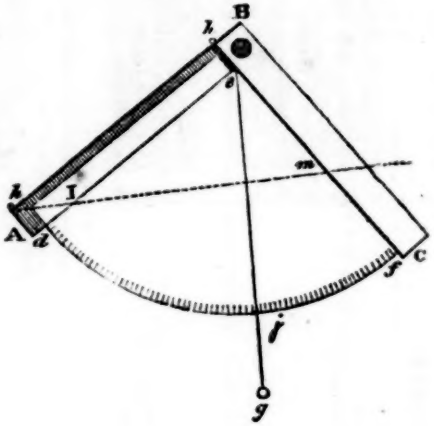
SECOND YEAR.

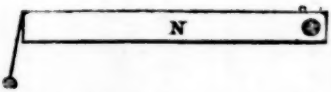
	DAILY EXERCISES.	WEEKLY EXERCISES.
FIRST QUARTER. **REMARKS.** No scholar is compelled to study all the branches assigned for any particular part of the course. Much less is he allowed, when his course has been selected, to make capricious changes.	1. Algebra, (continued.) *Colburn.* 2. Ancient Geography, (continued.) Use of globes. 3. Greek Reader, (continued.) 4. Latin Reader, second part, (continued.) *Jacobs.* 5. Telemachus. Written exercises in French. 6. Spanish. *Traductor Espanol.* Phrases. 7. German. *Shade's Grammar.* 8. Drawing. Elements of landscape.	1. Elocution. *Walker's Rhetorical Grammar.* 2. Natural Philosophy, illustrated by lectures and experiments. *Conversations, Jones' edition.* 3. Exercises in Greek. *Neilson.* 4. Composition, (continued.)
SECOND QUARTER. The exercises for Wednesdays and Saturdays are, in general, different from those of the other four days in the week, and are therefore classed under the head of *weekly exercises.*	1. Algebra, (continued.) 2. Use of globes, (continued.) 3. Greek Testament. (*Four gospels.*) 4. Latin Reader, (continued.) 5. Historical Reading, in French. *Peter the Great.* 6. Translations from Spanish, (continued,) and Spanish exercises. 7. German Reader. Grammar, (continued.) 8. Landscape drawing, (continued.)	1. Rhetorical Grammar, (continued.) 2. Natural Philosophy, (continued.) 3. Greek Exercises, (continued.) 4. Composition, with the study of its elementary principles. *Appendix to Murray's Grammar.*
THIRD QUARTER. The pupil, on entering the school, must have learned reading, writing, English Grammar, and the first rules of Arithmetic. A knowledge of Geography is also very desirable.	1. Geometry. *Legendre.* 2. Ancient History. *Worcester's Elements,* and charts. 3. Græca Majora, first volume. *Dalzel.* 4. Ovid. Latin Prosody. *Adams' Grammar.* 5. French, (continued.) 6. Spanish, (continued,) with written exercises. *Jossé* or *M'Henry.* 7. German, (continued. 8. Drawing, (continued.)	1. Mythology. *Tooke.* 2. Rhetorical Grammar, (continued.) 3. Natural Philosophy, (continued.) 4. Latin Exercises. *Dana's Latin Tutor.* 5. Compositions on themes selected.
FOURTH QUARTER. The text books of the school must be possessed by each scholar. The extent of the school, and the number of branches taught, render changes and varieties inadmissible.	1. Geometry, (continued.) 2. Ancient History, (continued.) Book-keeping, *Hitchcock.* 3. Græca Majora, (continued.) 4. Virgil. *Gould's edition.* 5. French poetry. 6. Spanish, (continued.) 7. German, (continued,) with written exercises. 8. Drawing from models.	1. Mythology, (continued.) 2. Rhetorical Grammar, (continued.) 3. Natural Philosophy, (continued.) 4. Latin Exercises, (continued.) 5. Composition.

THIRD YEAR.

	DAILY EXERCISES.	WEEKLY EXERCISES.
FIRST QUARTER. REMARKS. Before a scholar can be entitled to instruction in any branch, his fee for the quarter must be paid, for which a *receipt* is given, but no bills are sent out for collection.	1. Trigonometry, with application of Algebra to Geometry. 2. Modern History. *Worcester's Elements.* 3. Græca Majora, (continued.) 4. Virgil, (continued.) 5. Translations from English to French. 6. Double translations in English and Spanish. 7. German, (continued.) 8. Drawing from machinery. Laws of perspective.	1. Mythology, (continued.) 2. Rhetorical exercises. 3. Explanation of the structure and uses of machinery. 4. Latin Exercises. 5. Composition.
SECOND QUARTER. Each recitation occupies about *forty-five* minutes.	1. Surveying and Mensuration. 2. Modern History, (continued.) 3. Græca Majora, second volume. Greek Prosody. 4. Cicero's Select Orations. 5. Conversations in French and Spanish. 6. German, (continued.) 7. Drawing from subjects in Natural History.	1. Elocution, (continued.) 2. Chemistry, with lectures and experiments. 3. *Elegantiæ Latinæ.* 4. Composition.
THIRD QUARTER. The lectures on natural philosophy, chemistry, &c., pertaining to this course, are entirely distinct from the public lectures before the Institute, and are commonly given after the morning exercise on Wednesdays.	1. Astronomy. *Gummere.* 2. Political Economy. *Conversations.* 3. Sallust and Horace. 4. Græca Majora. Written translations from Greek. 5. Original compositions in French and Spanish. 6. Conversations in German. 7. Drawing, (continued.)	1. Rhetoric. 2. Chemistry, (continued.) 3. Elegantiæ Latinæ. 4. Composition.
FOURTH QUARTER. It is not expected that the whole of the above course can be completed in three years by any but scholars of the very best capacity, and most exemplary diligence. A few individuals now in the school are in a fair way to accomplish it.	1. Astronomy, (continued.) Calculation of Eclipses. 2. Constitution of the United States, and of the state of Pennsylvania. 3. Tacitus. 4. Græca Majora. Modern Greek. 5. French and Spanish composition, (continued.) 6. Natural History. 7. Architectural drawing.	1. Rhetoric. 2. Chemistry. 3. Elegantiæ Latinæ. 4. Composition.

A simple and easily constructed Instrument for observing the height of Objects, &c.





A B, B C, two equal pieces of wood turning on a screw at B, *e d f* a slip of parchment or paper pasted to the legs A B, B C, and folding between them when closed, after the similitude of a fan. Let the outer part *d j f* be made the quadrant of a circle to radius *e d*, and let it be divided into 90 degrees; *e j g* a plumb-line falling from the centre, and *h h*, two sights. If through *h h*, the top of any object be observed, the plumb-line *e j g* will cut off the number of degrees (*j f*) contained by the angle of elevation. The proof is very evident. Let *h I m* be the horizontal line, to which *e j g* will always fall perpendicular: and since *I e m* is a right angled triangle, ◺ (Euc. vi. 8) ∟ *f c g* = ∟ *e* I *m* = ∟ of elevation. The instrument may be closed as at N, and carried in the pocket. [*Register of Arts.*

Observations on the immediate effect of applying Oil to lessen friction in axle trees. By Mr. H. Palmer.

Mr. Henry Palmer, in his work upon rail-roads, makes the following observations upon a phenomenon which we believe had not been previously noticed; as it appears likely to suggest some valuable

ideas in the lubricating of delicate machinery, we have thought it worth insertion.

"During a succession of experiments, occasionally, for many months, I invariably perceived, that when fresh oil was applied to the axles of the carriage, *the resistance was increased*, and it required the ordinary motion of the carriage for several days to restore the resistance to its usual standard. No other presumption occurred to account for this fact, than the possibility of the oil being better adapted for its office after being some time exposed to use. It was suggested by a scientific acquaintance, that the oil became thickened, or less fluid, after exposure to the air, and was therefore better able to resist the contact of surfaces. In order to prove this, I thickened some oil artificially, by the admixture of a small quantity of bees' wax, but the appearances were the same as before. It then occurred to me that there was not sufficient play, or difference of diameters, between the axle and the nave in which it worked; I therefore had the axles slightly reduced. On again measuring the resistance, I found circumstances as before, but differing in amount, the resistance being slightly increased. I was by this time convinced that the quantity rather than quality of oil occasioned the appearances; to prove which the axles were made perfectly clean, and then simply moistened with oil by the finger previous to inserting them in the wheel. In this state the resistance was again measured, and found to be *similar to the standard usually observed* after the carriage had been some days in motion as before described. It being then proved that the *quantity* of oil occasioned the difference of resistance, the following solution of the manner in which the additional quantity could produce such an effect, appeared reasonable:—

Fig. 1.

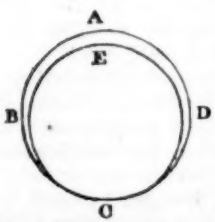
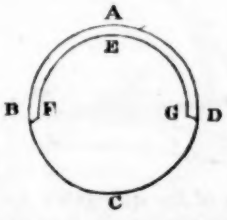


Fig. 2.



"Let A, B, C, D, Fig. 1, represent the circle of the hole in the nave of the wheel, and E, C, the section of the axle. The circle E, C, touches A, B, C, D, only in the point C. A very acute angular space then remains between A, E, and C, on either side of E, C. If that space be filled with oil, the oil may be considered as a wedge, and if the outer circle be set in motion, that wedge will endeavour to pass the point C: But it cannot pass in its present form without raising the circle E, C; but E, C, having the weight of the carriage upon it, would resist its passage.

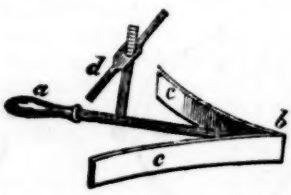
"Now this continual and unsuccessful endeavour to pass the point C, will occasion an impediment to the motion.

"To put this solution to the test, the axles were formed as in Figure 2. A, B, C, D, is the hole in the nave as before, and E, F, G, G, the section of the axle. The lower semicircle of the axle here corresponds with, or is parallel to the outer circle, but no farther, because, *if it corresponded throughout the circle, the axle would be liable to jamb, as other experiments have proved.* The coincidence then ceases abruptly, as at B, F, G, D; and the space above, which contains the oil, is not angular, but the quantity of oil which is to pass toward the lower semicircle is determined at B or D.

"On measuring the resistance with the axle thus formed, I found it not increased by any quantity of oil that might be inserted, but by dispensing with the angular space and consequent wedge-like action of the oil, *the resistance was one-tenth less than the former standard.* In cases where the difference of diameters is considerable, I do not apprehend the obstruction from the quantity of oil would be of consequence: but it is desirable to make the bearing surfaces nearly to correspond, to obtain a greater *width* of touching surface, and the more perfectly to govern the motion. The form of axle just described, is, in fact, the converse of a well made plummer block used in machinery." [*Ib.*

Description of an Expanding Wedge for Sawyers.

The Society of Arts has presented the "Silver Vulcan Medal" to Mr. T. Griffiths of the Royal Institution, for the invention of an expanding wedge, for the use of Sawyers, a representation of which we here annex.



a is the handle or centre piece, to which is connected two springs *c c*, joined together at *b*, the handle also carries a cross piece *d*.

This instrument is intended chiefly to save the *time* and *trouble* of shifting the common wedges, while sawing up logs of pine, &c. into boards. When the saw has cut two or three feet, the loose ends of the springs *c c* are to be brought, by hand, as near to the centre piece *a* as their elasticity will admit; the end *b* is then to be introduced into the cut, and the wedge is to be thrust up to the end of the spring, the cross piece *d* resting on the upper surface of the balk. The elasticity of the springs will then be continually opening the cut as the saw proceeds to the length of about twelve feet, and the wedge, when at its utmost expansion, will be prevented by the cross-piece from falling into the pit. It requires to be adjusted only once in twelve feet. [*Abridged from the Trans. Soc. of Arts.*

The "trouble" of pushing in the common wedges used by Sawyers is very little indeed; the "time" occupied is but a few seconds.

and at those periods when the men rest a minute or two from the laborious operation of sawing. We much doubt whether sawyers would use Mr. Griffith's expanding wedge, if given to them; and we are quite sure, that they would not, out of regard to the invention, make a cut twelve feet long through a thick piece of timber without stopping. It is difficult to conceive what must be the feelings of a member of the *Royal Institution*, when he receives an honorary medal from a scientific body, for such a common blacksmith's job. We are bold to say, that any man of ordinary capacity, with a taste for practical mechanics, would invent one hundred things, quite as important and valuable, every day for a month together, were the subjects proposed to him. [*Editor Journal Arts.*

Description of a Plane for Hard or Cross Grained Wood, for which a reward was given to the inventor by the Society of Arts.

The cutting edge of an ordinary plane-iron, has been hitherto uniformly produced by grinding, or otherwise forming a slope or bevil upon only one side of it; the blade being then fixed in the stock of the plane, in such a position as to form an angle of about 45 degrees with the lower surface, its operation upon the wood is partly of a *cutting*, and partly of a *scraping* nature. In planing some kinds of wood, great inconvenience was found from this form by its frequently tearing up the surface, instead of smoothing it; a partial remedy for this defect was in consequence introduced about 24 years ago, by which another plane-iron, called a *top*-iron, was added to the under one, by means of a strong connecting screw, which caused the top iron, particularly at the edge, to press closely upon the lower one, as shown by the annexed figure (which is an edge view of the lower ends of both,) *d* being the lower iron, and *e* the upper. The cutting edge of *d*, which projects a little beyond *e*, is therefore the same as before, but it is prevented from entering so deeply into the wood, or rather the shaving which has been abraded from the wood, receives a new direction by the abrupt interposition of the top iron *e*, and is thus prevented from causing a tearing up with the grain, to the destruction of a level surface. The advantage of the "double plane iron" over the "single plane iron" being, therefore, unquestionable, the latter are consequently almost disused; the remedy is, nevertheless, incomplete, inasmuch, as the lower iron presents the same angle as before; it cuts *better*, it is true, but recourse to the scraper is still necessary.

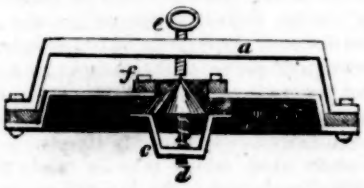
The improvement now introduced is the invention of an ingenious workman named Williamson. It consists simply in employing the *single iron* as previously used, which is to be made of cast steel, of greater thickness than usual, and to be *bevilled on both sides*, as represented in the annexed section of a portion of a plane. *a a*, is

part of the body, *b* the wooden wedge, and *c* the plane-iron as fixed. By this form of edge, it will be perceived that it partakes more of the action of the *scraper*, and obviates more effectually the defects and objections to the former constructions. The edge is more strong and durable, it gives a beautifully smooth surface, almost without the aid of the scraper; and is considered to be peculiarly valuable in planing hard or coarse grained woods, and in cutting woods against the grain.

Remarks by the Editor.—The foregoing improvement, as it is denominated, has been rewarded, commended, and published in several scientific journals; yet, in despite of all this favourable testimony, we venture to assert, that the double bevil, upon which its merit appears to rest, is a point of no importance whatever, and that a common single bevilled iron, placed in the stock, so that its face should form the same angle with the face of the plane, which is formed by the cutting side in the drawing, would cut as steadily and smoothly, as if double bevilled. The irons of toothed planes for veneers, of planes for brass and copper, and for many other purposes, are generally denominated upright irons, by the workmen; not that their faces always form a right angle with the face of the plane, but because they are more upright than in ordinary planes, and they are so placed that they may operate as scrapers. All that can affect the cutting of a plane iron are its firmness, the angle its cutting edge forms with the face of the plane, and the angle of the cutting edge itself, and it is perfectly evident that these may be the same, whether the iron be ground in the ordinary way, or in the manner proposed by Mr. Williamson. The top iron the Editor can remember for 40 years past.

Description of a Safety Valve for Steam Boilers.

This valve is the contrivance of Mr. C. Sockl, who has been rewarded by the Society of Arts, with their large silver medal, and ten guineas, for the invention. It appears to be calculated to afford very great security, and, in the opinion of the inventor, is peculiarly applicable to steam boilers on board of vessels.



Instead of the solid lid which covers the main hole, a copper-plate or dish is to be substituted, as shown in the above figure. *b* is the

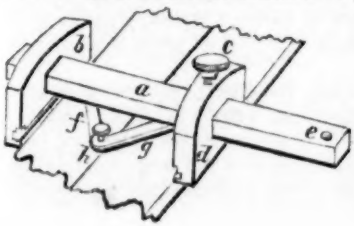
copper dish, surrounded by a ring of the same, by which the plate is firmly screwed down upon the rim of the main hole. In the middle of the plate is fixed the valve, of which *f* is the collar, made of iron or brass; *d* the plug, which is ground air-tight into the collar, and is kept in its place by the spiral spring which surrounds its stem, and the stay *e*: over the whole is fixed a strong cross piece *a*, which is firmly screwed down upon the ring that secures the plate *b*. In the cross piece works the regulating screw *e*, which may be screwed down upon the head of the plug.

The operation of the valve is easy to understand. *b*, the plate or dish, is only one-fourth or one-third the thickness of the other parts of the boiler; it will not afford the same resistance to the steam: when this, therefore, gets beyond the ordinary pressure, it will cause the plate to become somewhat convex, and will thus leave a clear space between the collar *f*, and the conical plug *d*, for the steam to escape; as soon as the power diminishes, the plate will, by its elasticity, return to its former place, and by closing down upon the plug, prevent any further escape of steam.

The object of this valve is not so much to regulate the working pressure of the steam, as to act in aid of the common valve, by affording an additional aperture in case the steam should acquire a dangerous degree of force. It differs from the plug valves in common use in this circumstance, namely, that in the latter, the plug rises out of its socket, in order to allow a vent for the steam; whereas, in Mr. Sockl's, the socket rises away from the plug: the chief advantage resulting from this is, that if any adhesion should have taken place between the plug and the socket, it is more likely to be overcome, on account of the great surface of the socket with its attached copperplate, which are exposed to the action of the steam.

Description of a Bisecting Gauge, invented by H. R. PALMER, *Civil Engineer.*

THIS contrivance is for the purpose of marking a line along the centre of any parallel or tapering solid, which, from its construction, it is evident, it will do with the greatest accuracy. It answers all the purposes of the common gauge, while it is peculiarly serviceable in other respects for which the common gauge is wholly inapplicable; in making mortices, and in enabling workmen to measure from a centre line, and to work with greater accuracy and facility, and in many other cases it would be found a very convenient instrument.



The annexed figure is a perspective view of the gauge. *a* is a square bar of hard wood, having two sliding cheeks, *b d*, fitted tightly to it. The cheek *b* is fixed fast on one end of the bar, whilst the other slides upon it, but may be made fast at any required place by the thumb-

screw, *c*. At the end, *b*, a common scribing point is fixed in the bar, and with this and the sliding piece *d*, it forms the common gauge used for drawing parallel lines from the edge of any piece of wood work. The addition made by Mr. Palmer consists of two brass arms, *f* and *g*, of equal length, which are centred in the two sliding cheeks, at *a a:* the other ends are jointed together by the screw, *h*, which is formed into a sharp conical point beneath, to mark the work with.

In using this gauge it is evident that the point of the screw, *h*, will always keep in the centre between the two cheeks, *b d*. If the work is not parallel in its width, then the screw, *c*, must be loosened, and the two cheeks, *b d*, must be kept pressed towards each other so as to be in contact with the sides of the work; when the point *g* will traverse along the centre of the piece as correctly as if its sides were parallel; because in all situations it preserves an equal distance between the two cheeks, *b d*. These two cheeks have grooves made in them, to receive the brass arms, *f* and *g*, when the cheeks are brought into contact.

Remarks by the Editor.—A gauge similar in principle to that above described has been long in use, particularly for the purpose of gauging pillastres for the purpose of fluting them; it is usually made by taking three strips of wood, and joining them together with screws somewhat in the form of the letter H. The connecting piece is a little longer than the width of the pillastre at the widest part; each of the end pieces is allowed to swivel upon the screw by which it is attached to the connecting piece; this latter is laid off for the flutes and spaces, and into each division a pointed sprig is driven so as to form a marking gauge. By using the end pieces as guides, the pillastre will be gauged for fluting, and the diminution of the flutes will correspond with that of the pillastre.

Improvement in the Tea Kettle, and other vessels for culinary purposes.

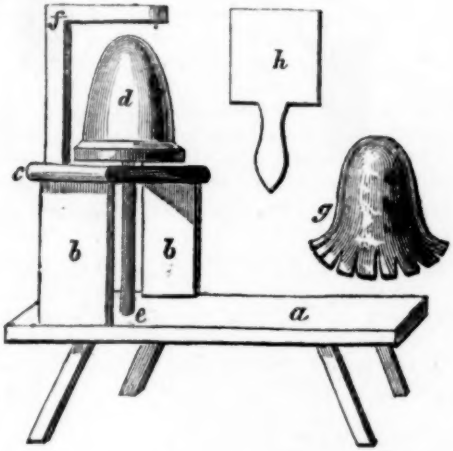
A Mr. Gordon, of London, is manufacturing tea-kettles, and other culinary vessels, which are said to be very economical; the improvement consists simply in enclosing vessels of the ordinary kind, such as tea-kettles, stew-pans, &c., with an outer casing surrounding their sides, but open at the bottom, for the flame of a lamp to act upon it. When heat is applied to vessels so constructed, the plate of air between the cases becomes highly rarified, and the heat, having no tendency to descend, accumulates in the upper part to such an intense degree, as to be capable of melting a rod of glass if passed up the cavity.

In vessels of the usual construction, the greater part of the heated air escapes without producing any useful effect; in these, however, it is detained, and the water may in consequence be boiled in a very short space of time. The chief advantages of the new construction are, therefore, economy of heat, or of the inflammable matter em-

ployed in producing it, economy of time, and convenience; the value of these may be variously estimated by different individuals, but all will acknowledge that they are important.

On improved Melting Pots, for Cast Iron and Brass.

In the 2nd vol. of this journal a description of Anstey's improved melting pots was given, and to this article we refer our readers. We have obtained an engraving of the apparatus used by Mr. Anstey in forming them, which we insert to render the article referred to, more clear and useful.

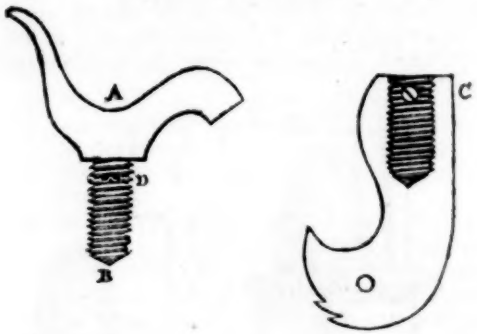


Every brass, or iron founder, must be fully sensible of the value and importance of melting pots, for the fusion of metals, that will remain unaltered after exposure to the intense heat of an air furnace. The composition employed in the manufacture by Mr. Anstey, consists of two parts of Stourbridge clay, and one part of the hardest coke, well ground and tempered together, according to the following recipe.

Take two parts of fine ground raw Stourbridge clay, and one part of the hardest gas coke, previously pulverized and sifted through a sieve of one-eighth of an inch mesh. Mix the ingredients together with the proper quantity of water, and tread the mass well, (if the coke is ground fine, the pots are very apt to crack.) The pot is moulded by hand on a wooden block, as shown in the engraved figure, in which *a* is the bench; *b b* two uprights, supporting a cross board *c*, and ends in a pin that turns in a hole in the bench; *f* is a gauge to regulate the thickness of the melting pot, as shown by the dotted lines; *g* is a cap of linen, or cotton, placed wet on the core before the clay is put on; its use is to prevent the pot from sticking partially

to the core while it is taking off; the cap adheres to the pot only while wet, and may be removed without trouble or hazard (to the pot) when dry: *h* is a wooden bat, to assist in moulding the pot; when moulded, they are carefully dried at a gentle heat.

Improved Fire Arms.



THE following is a plan for discharging a double barrelled pocket pistol, on the percussion principle, with only one lock. It is quite as simple, and more certain, than the way in which it is effected with the flint lock.

The barrels are placed side by side, or they might with a little more workmanship, be placed one above the other, and each has its separate nipple. The cock will be better understood, by referring to the figure: the upper part of it A, is fixed to the lower part by the strong screw B, and a small pin or screw C is passed through them both, the hole D being wider than the pin, in order to admit of the top of the cock being turned a little one way or the other.

The pistol is kept with the cock turned either way; and on one barrel being fired, all that has to be done, is to cock the pistol again and turn the cock the other way as far as it will go, when it will be ready to strike the cap on the other barrel. [*Ib.*

Optical Amusements.

GENTLEMEN,—As I find that your object is to familiarize scientific truths, and, to use a homely phrase, make useful knowledge available to "the vulgar," I readily furnish my quota to so laudable an undertaking. As I have paid particular attention to optical science, with reference to the amusement to be derived from its pursuit, I cannot do better than commence my papers by furnishing a series of curious optical experiments, which may be performed without costly apparatus.

A curious optical deception may be thus produced. It is to exhibit an erect object, which, when placed near a hole in a card, will appear to be on the other side, and also inverted and magnified. Let a card be perforated with a small hole, and placed opposite a white wall or window, the eye of the observer being situated on the other side of the card. A pin being then placed between the eye and card will be seen on the other side of the aperture, inverted and magnified as already described. The reason of this is, as M. Le Cat has observed, that the eye, in this case, sees only the shadow of the pin on the retina, and since the light which is stopped by the upper part of the pin or its head, comes from the lower part of the white wall or window, whilst that which is stopped by the lower end of the pin comes from the upper part, the shadow must, necessarily, appear inverted with respect to the object. The accidental variations of the temperature of the air, at different depths, produce great irregularities in its refraction, especially near the horizon. The most remarkable of these is occasioned by the refraction of the air in the neighbourhood of the surface of water, of a building, or of the earth itself, in consequence of which a distant object appears to be depressed, instead of being elevated, and is sometimes seen at once both depressed and elevated, so as to appear double, one of the images being generally in an inverted position, as if the surface possessed a reflective power; and there seems indeed to be a considerable analogy between this kind of refraction and the total reflection which happens within a denser medium. These effects are known by the appellations, *looming*, *mirage*, and *Fata Morgana:* they may be very completely imitated, as Dr. Wollaston has shown, by looking at a distant object along a red-hot poker, or through a saline or saccharine solution with water, and spirit of wine floating on it. The effect of refraction on the apparent places of terrestrial objects must be frequently disturbed by circumstances of this kind; but its magnitude is usually about one tenth of the angular distance of the object, considered as a part of the earth's circumference.

The following experiment which illustrates, in a pleasing manner, the actual formation of haloes, has been given by Dr. Brewster. Take a saturated solution of alum, and having spread a few drops of it over a plate of glass, it will rapidly crystallize in small flat octohedrons, scarcely visible to the eye. When this plate is held between the observer and the sun, or a candle, with the eye very close to the smooth side of the glass-plate, there will be seen three beautiful haloes of light, at different distances from the luminous body. The innermost halo, which is the whitest, is formed by the images refracted by a pair of faces of the octohedral crystals, not much inclined to each other. The second halo, which is more beautifully coloured, with the blue rays outwards, is formed by a pair of faces more inclined; and the third, which is very large and highly coloured, is formed by a still more inclined pair of faces.

Each separate crystal forms three images of the luminous body, placed at points 120° distant from each other, in all the three haloes; and as the numerous small crystals have their refracting faces

turned in every possible direction, the whole circumference of the haloes will be completely filled up. The same effects may be obtained with other crystals, and when they have the property of double refraction, each halo will be either doubled, when the double refraction is considerable, or rendered broader, or otherwise modified in point of colour, when the double refraction is small. The effects may be curiously varied, by crystallizing, upon the same plate of glass, crystals of a decided colour; by which means we should have white, and coloured haloes, succeeding each other.

Yours, &c. OPTICUS.

[*London Journal.*

BURSTALL *and* HILL'S *Steam Carriage.*

THE patentees of the Edinburgh Steam Carriage, which has been mentioned several times in our preceding volumes, have brought to London a working model of their invention, for the purpose of demonstrating the practicability of running a steam coach upon ordinary roads. This model, which contains several improvements upon the former patent, is made upon a scale of three inches to the foot of the intended stage coach, which is, they say, in considerable forwardness.

As we have not yet reported the specification of the last improvements proposed in connexion with this invention, we shall not at present enter into a particular description of the model, but merely say that, in our opinion, the arrangements of the machinery do the patentees great credit; the model is neat and performs extremely well.

It is, however, to be remembered, this is but a model, and though the practicability of constructing a steam coach, that should be capable of travelling upon ordinary roads, may be demonstrated, (which we have never doubted,) yet it is by no means proved how far a sufficient speed can be obtained, or what economy may be derived in working a full sized stage coach by steam, instead of horses.

The model is constructed on a scale of 3 inches to the foot, is 5 feet six inches long, 16 inches over the wheels, and 1 foot 10 inches high, the middle or propelling wheels being 13 inches in diameter.

"The full size carriage is intended to be about one foot longer than a two horse stage coach and horses. Seven feet four inches high to the roof, the wheels being the common breadth apart. It will be retarded or stopped in running down hill by a powerful lever and friction-break, which acts on the two fore wheels, within reach of the conductor; at the same time, by a crank and rod, the throttle valve is closed, which shuts off the steam. The engineer behind can at pleasure stop the engine.

"The machine, with all its wheels smooth, and without either propellers, or any other adhesion on the ground, except the natural friction of the iron against the road, carries with ease and rapidity, up an ascent of one in eighteen, a weight equal to forty passengers upon a common stage coach, demonstrating that, on *this plan*, stage coaches

may be propelled with *safety, economy and speed*, not to be attained with horse coaches, and capable of making the present common roads of the country fully as economical as rail-roads, except in situations of extraordinary traffic.

"The boiler is so constructed as to be perfectly safe, and the most timid person may view the working of the model without either danger or annoyance." [*Ib.*

ENGLISH PATENTS.

Account of a Patent obtained by John Palmer de la Fons, *Dentist, and* William Littlewart, *Mathematical Instrument Maker, for their Invention of an Improvement in Securing or Mooring Ships, and other floating bodies, and Apparatus for performing the same.* Enrolled January, 1827.

Instead of securing ships and other vessels in harbours, rivers, and creeks, by means of anchors, or mooring blocks, as usual, the patentees propose to drive piles into the earth or sand in the bed of the harbour or river, from which piles, chains are to be carried to floating buoys, and to these the vessels are to be secured by mooring chains.

This mode of securing ships and other vessels by piles, instead of mooring blocks or anchors, constitutes the leading feature of the invention, and claim of patent right; but the manner of fixing these piles in the ground, below the water, is described in the specification, though not claimed.

A large conical rim of iron is provided, having a tube passing through it in the direction of an axis, which tube swings in jimbles, or a ball and socket, at the upper part of the conical rim, in order that the tube shall preserve a perpendicular position, however uneven may be the ground upon which the case of the conical rim may rest. Into this tube, the pile is introduced, and, with the conical rim, is let down to the bed of the harbour or river, by means of a crane or windlass, mounted upon a platform between two stationary vessels, placed over the spot where the pile is to be driven.

The conical rim now resting upon the ground, with the pile erect, its point downwards, a chain is attached to an iron ring in the top of the pile, which chain is affixed above to a pile driving apparatus of nearly the usual construction. The rammer or weight of the pile driver is now let fall, which sliding down the chain, strikes the head of the pile, and by repeated strokes, drives it into the earth.

When the pile has been driven sufficiently far into the ground, the conical rim is drawn up, and the vessels with the apparatus removed to another station, for the purpose of driving a second pile, and so on until the required number of piles are all fixed.

The series of piles are proposed to be placed in a circle or square range, in the centre of which the floating vessel is to be moored, by

means of ropes or cables extending from the vessel to the buoys and mooring chains of the several piles. In this way of mooring the vessels, the draft upon the piles will be seldom upwards, but principally in a lateral direction, which they will be able to resist, being firmly fixed in the ground. [*Ib.*

Account of a Patent obtained by John Lane Higgins, Esq., *for his Invention of certain Improvements in the construction of Cat-Blocks and Fish-Hooks, and in the application thereof.*—Enrolled January, 1827.

The apparatus which forms the subject of this patent is a pulley-block for taking hold of, or fishing an anchor, and for drawing it up, or catting it, in the act of weighing the anchor.

The patentee states, that the mode of catting an anchor according to the usual practice, is attended with so much labour and inconvenience, that in passing down a river, in order to save the trouble of hauling it in, the anchor is frequently left suspended from the vessel, below the surface of the water, which greatly impedes its progress.

Without describing the invention in the nautical terms which the specification sets forth, it will be sufficient to say, that the "*Fish-hook*," or hook by which the ring at top of the anchor is taken hold of, when drawing it out of the water, has an eye or hole at the back, through which a rope is passed. By this hook, which is attached to the pulley or "*Cat-block*," suspended from the cat-head, the anchor is drawn up, and held until it can be made fast on board the vessel. The rope from the eye at the back of the hook, being, at the same time, passed over the end of the cat-head, and secured.

Should it be necessary to let go the anchor suddenly, the tackle of the cat-block is to be relaxed, when the rope passed through the eye of the hook becoming tight, draws the hook back, and thereby allows the anchor to slip over the point of the hook, and descend through the water to the bottom. [*Ib.*

Account of a Patent obtained by William Hobson, *Gentleman, for his new Invented Improved Method of Paving Streets, Lanes, Roads, and Carriage Ways in general.*—Enrolled March, 1827.

The first and most essential matter in paving the highways of public streets and roads, where there is a very great traversing of heavy carriages, is to lay a solid and firm foundation previous to placing the paving stones. With this consideration in view, the patentee commences by spreading, evenly, the earth, rubbish, or any material of which the foundation of the road way is to be formed, and then ramming it hard, or rolling it, so as to produce a very sound and firm bed. He then proposes to break stones into small pieces, and spread them over the previously rammed earth, upon which broken stones,

forming a sort of M'Adamized foundation, the regularly cut paving stones are to be placed.

The intended forms of the paving stones are not specified; but it is to be presumed, that they are to be cubes, which being placed close together, and properly rammed, the interstices between the stones are to be filled up with a sort of cement or grout, made of sand, lime, and water, and which, when dry, will securely bind the stones together, and form them into one entire terrace.

The same method may be adopted when the road is formed of pebbles, (viz.) first ramming the foundation very hard, and then spreading the broken stones upon which the pebbles may be placed, and cemented together by pouring upon them grout or fluid containing such substances as will coagulate, and on drying, become a hard, adhesive substance, similar to stone. [*Ib.*

Account of a Patent obtained by John Gregory Hancock, *Plate Bender and Canister Hinge Manufacturer, for his Invention of a New Elastic Rod, for Umbrellas, and other like purposes.*—Enrolled January, 1827.

These elastic rods are made from ozier twigs, cut to any convenient length, and the pith removed from the internal part of the ozier twig by an ordinary boring tool. When this has been done, a rod of steel is introduced into the hollow part of the twig for the purpose of giving it stability.

The external part of the ozier twig may be now scraped or plained down, and finished by painting and varnishing, and ferrules or shoulders may be attached to the rod as may be required, for the purposes of sticks, whips, or the stems of umbrellas, or any other purpose to which these rods may be applicable.

The patentee claims to be the first inventor and maker of rods formed in this way. [*Ib.*

Account of a Patent obtained by Robert Dickenson, *in consequence of a communication made to him by a certain Foreigner residing abroad, for an invention for the formation, coating and covering of Vessels or Packages, for containing, preserving, conveying, and transporting goods and products, whether in liquid or solid forms, and for other useful purposes.*—Enrolled June, 1827.

The subject of this patent divides itself into two parts: first, the formation of a metal barrel, cask, or other vessel of capacity, suited to the packing and conveyance of food and other perishable commodities, on ship-board, and in foreign climates; and, secondly, in a

mode of, and material for, coating the said metal barrels or casks, to prevent rust.

The patentee describes the new invented vessels to be barrels or casks, made of plate iron, in a cylindrical or a prismatic form, one end of which is secured by doubling the edges of the metal over, or by soldering them together, or by any other means that may be found convenient to render the joints air-tight; the other end, which may be called the top, has the edge of the iron plate turned inwards, for the purpose of forming a ledge to support the moveable end or lid, and a hoop of metal is rivetted or otherwise fastened round the interior of the vessel, near the top, standing up, and by that means producing a recess or groove, into which a gasket or elastic pad is to be placed, in order to render that joint air-tight when the lid is put on.

The gasket or pad is to be made by a ring of tin plate, or some such material, formed to the shape of the vessel, and then wound round with flannel or other flexible substance, and coated on the outside with oil-skin, or oiled silk, which being soft and elastic, will be easily pressed into the groove, and produce a perfectly air-tight joint when the lid is put on.

The lid being a circular plate, or of any other form suited to the shape of the vessel, is placed upon the gasket or pad, and several sliding bolts or latches attached to the outside of the lid, are then to be projected into corresponding holes or slots perforated through the upper part of the rim of the vessel, and the edges of which holes or slots are to be made inclined or bevelled, for the purpose of drawing the lid tight down upon the gasket, when the bolts are projected. Thus the vessel is headed or closed, and the goods within preserved from the action of the external air.

It is a very extraordinary circumstance, that the same construction of iron barrels, or casks for packing perishable goods, is described, as the subject of a previous patent granted to the said Robert Dickinson, in October, 1824. (See the 5th volume, page 369.)

The vessels, when constructed of sheet iron in the way above described, are to be tinned according to the ordinary process of tinning, and they are afterwards to be covered with an alloy or mixture of metals made in the following proportions:—

Take seventy-five pounds of tin in ingots, and having melted it in a furnace in the usual way, add to it twenty pounds of zinc; when these are properly melted together, then introduce five pounds of finely pulverized glass, and stir the whole until it is uniformly mixed together. These proportions are considered to be the most eligible, but a slight variation therefrom would be of but little consequence.

With this composition in a fluid state, the barrels or casks are to be coated in a similar way to tinning, and after that has been done, another coat of tin is put upon it, which completes the process, and protects the iron from the action of the atmosphere, and consequently precludes the possibility of its rusting.

In these vessels it is intended to pack flour, bread, biscuits, or any

other kind of provision, and to keep it secure from the atmosphere, and from vermin on shipboard, and elsewhere. The same kind of vessels are likewise suited to hold a great variety of other perishable articles, and to preserve them from injury in a very superior way to any other kind of packing. [*Ib.*

Account of a Patent obtained by VALENTINE BARTHOLOMEW, *Gentleman, for his Invention of Improvements in Shades for Lamps, and other Lights.*—Enrolled February, 1827.

THE patentee proposes to construct a lanthern of an octagon or any other eligible form, with ornamental framework, and panels of painted glass, or other transparent medium, which lanthern is to be put over the lighted lamp, and the subjects contained in the transparent panels by that means are illuminated. The frame-work of the lanthern is made to imitate a gothic building, the transparent panels representing windows.

Over the burner of the lamp, which may be of gas, or oil, of the Argand, or any other construction, an arched wire is carried, having a point at top to support and suspend the lanthern, and the aperture in the upper part of the lanthern for ventilation, is covered by a fan, in the centre of which there is a small hollow, intended to bear upon the central point when the lanthern is placed over the lamp, and equally poised.

The heat of the lamp rising to the top of the lanthern, creates a current of air, which in its passage through the fan, turns the fan and the lanthern slowly round, upon the centre or supporting point, and thus by the rotation of the lanthern, the transparent subjects are successively brought into the view of a spectator.

We are not aware what particular feature of novelty appertains to this invention, nor what the patentee intends to claim as his invention, as lantherns with transparent painting have been in use for ages, and are commonly called Chinese lantherns. As to the rotatory motion produced by the heated air passing from the burner through the fan at top, that is a simple philosophical experiment which we have known for many years applied exactly in the same way.—[*Ib.*

AMERICAN PATENTS.

Specification of a patent for an improved mode of fixing the Mariner's Compass. Granted to LEMUEL LANGLEY. Dated May, 1828.

To all to whom these presents shall come, be it known, that I Lemuel Langley, of the town of Norfolk, in the state of Virginia, have invented an improvement in the mode of fixing the Mariner's Compass, which is described in the words following; to wit,

The object of my said improvement is to dispense altogether with the binnacle, in which the compass is ordinarily fixed, to cause it to answer all the purposes of a 'tell tale,' and to secure it against accident from cannon shot, the shipping of heavy seas, or other causes of injury. The mode in which these ends are attained, is by cutting a hole through the deck of the vessel, at or near the place where the binnacle is usually situated; this hole is cut through into the cabin, and within it is placed the compass with its box, suspended in the usual way, and when so situated it is completely out of the reach of cannon or other shot. In order to cause it to act as a *tell tale*, the compass box is made with a glass bottom, so that the card can be seen as perfectly in the cabin, as upon deck; I also make the compass card translucent, or semi-transparent, in consequence of which it may always be lighted from below, and will be much more plainly seen at night, than when lighted in the ordinary way. The compass is defended at top by a very thick piece of glass; such as I have used has been three-fourths of an inch in thickness, and this is also defended by a rim, or band projecting above the deck; the lower side of the box is also glazed; and I contemplate sometimes making the sides of the box of glass, should it be desirable to admit light in that way.

What I claim as new in the above described invention, is the fixing of the compass entirely within the planking of the deck of a vessel; and the mode of rendering it equally visible, both upon deck, and in the cabin.

LEMUEL LANGLEY.

Remarks by the Editor.—We have seen but few things better calculated to answer the intended purpose than the foregoing invention. Whilst the deck of the vessel remains, the mariner's only guide, the compass, is perfectly secure. The small projection which it has been thought best to give to the glazed rim, may be completely protected from cannon shot, by a wide plate of iron fixed around it, so as to rise a trifle higher than the rim, whilst its edges are level with the deck. A British vessel was in the port of Norfolk when Mr. Langley was fixing one of his compasses on board a United States vessel, the captain of which preferred it very much to the costly binnacle and tell tale with which his own ship was furnished; there is but little doubt, therefore, that we shall soon see the invention patented in England, as it is not there required that the patentee should be the inventor. Mr. Langley, we believe, has not taken any measures to secure it for himself in that country. We frequently recognise the improvements made by our countrymen, in the accounts of English patents; of this we have no right or inclination to complain, but we cannot help feeling that justice requires that the credit of having made useful inventions, or discoveries, ought to be given to the country to which they belong; the situation of the Editor will enable him hereafter to attain

this end in almost every instance, and his inclinations will lead him to give it the required attention.

Patent granted to JAMES P. ALLAIRE, *for a "Steam Chimney or Receiver."* Dated May 14th, 1828.

THE improvement is an application of the heat, that usually passes up the chimney and is lost, in such a manner, to the steam after it is generated, as to rarify, or still further expand it. It consists of a steam chimney or receiver, so constructed that the steam generated in the boiler must, when used, pass over, or by the heated metal of the fire chimney, in such quantities only as is necessary to supply the engine.

The space from the external part of the steam chimney or receiver, to the external part of the fire chimney being small, each renewed supply of steam passing through the steam chimney or receiver, is brought in contact with the heated metal of the fire chimney, which imparts the extra heat in the metal to the steam, thereby keeping the temperature of the steam used, nearly up to that of the metal of the fire chimney, and also preserving the metal from oxidation or burning.

As the improvement consists in passing the steam over, or in contact with the heated metal to promote expansion, without exposing it to oxidation, the fire may be applied outside of the steam as well as inside, by having the conductor of the steam of a suitable size, and surrounded by fire.

It may be used for distilling, heating rooms, &c.

JAMES P. ALLAIRE.

Remarks by the Editor.—The foregoing specification appears to us to be less definite than such an instrument ought to be, as it does not particularize any arrangement by which the intended effect is to be produced; from the words of the patent law, and from the nature of the thing to be done, this would appear to be necessary to a good description. Flues have been repeatedly passed through the steam in the upper part of a boiler, for the purpose of giving to it a higher degree of elasticity, and thereby avoiding, in some degree, the waste of that heat which passes up the fire chimney. The advantages expected from this mode of procedure have, however, never been realized, as the application appears to have been made upon mistaken views. We would call the attention of our readers to Mr. Perkins' paper upon explosions in steam boilers, published in p. 417, vol. 3, in which some remarks occur which tend to throw light upon this subject. That the expansive force of steam depended upon its density and temperature conjointly, was a fact well understood among

philosophers, but, until the publication of this paper, we believe that the influence of temperature was greatly overrated, and that of density undervalued. When heat is applied to the water in a boiler from which steam has been generated, and over which it is confined, the effect is to increase the density of the steam, by increasing the evaporation of the water; but when heat is applied to the steam, so as to increase its temperature, and cause it to transcend that of the water, its density will be thereby diminished, as a portion of the steam will be condensed by the water, in consequence of its lower temperature. Water at 212° will undoubtedly abstract heat from steam at 250°, or indeed, at any superior temperature.

Mr. Allaire may probably expect to derive some advantage from heating the steam just as it is passing into the vacuum in the cylinder, as this appears to be his intention; but we apprehend that this advantage, if any, will be very small, as the *density* of the steam in his cylinder will be less than that in the boiler.

We have thrown out the foregoing hints, because we believe that they relate to facts not generally understood, although of the first importance in the operations with steam. Were we to follow our inclinations, we should occupy several pages with our views, but as we shall frequently add remarks to the patents we publish, we think that we ought to be as brief as possible. To some of our readers who take an interest in such subjects, the view which we have taken of the importance of density in steam may be altogether novel; for their sakes we will offer one remark, with the hope of giving clearness to the ideas which we have expressed.

The force of steam results from the power which heat possesses of causing the particles of matter to repel each other; if you diminish the number of particles in a given space, you decrease the amount of repulsion, and to restore this amount the heat must be increased; and, *vice versa*, if you can contrive to increase the number of particles of matter, the amount of repulsion may be equal, although the temperature may be diminished.

We are acquainted with heat only by the effects which it produces upon other bodies; as an abstract principle it is an entire stranger to us; however highly a cylinder may be heated, its piston will remain unaffected if there be a vacuum within it, and *cæteris paribus*, the effect upon the piston will be proportioned to the quantity of matter, in the form of vapour, which the cylinder may contain.

Decision in the Circuit Court of the United States, in the case of Dr. Hull's *Patent Truss for Ruptures.*

Under the head of American Patents, we shall present not only the specifications and accounts of the patents themselves, but whatever relates to the interest of patentees generally. In conformity with this resolution we abstract from the New York Evening Post the

result of a recent trial which has taken place in that city, and shall hereafter endeavour to obtain concise reports of decisions in all similar cases. Gentlemen of the bar, are particularly invited to aid us in this department, as by so doing they will establish a permanent record of such cases, and may in this way benefit the community, and probably promote the interest of the profession.

Sir,—A suit was brought a few days since, in the Circuit Court of the United States for the Southern District of New York, for violating Dr. Hull's patent for trusses. A number of respectable witnesses were introduced on the part of the patentee, viz: Drs. Mott, Perkins, Reese, Osborne, and Stearns; and judge Thompson, in his charge to the jury, told them that it had been clearly proved that the trusses in question were an imitation of Dr. Hull's. He further remarked, that it appeared that they were of the greatest value in surgery, and had been the means of effecting cures in cases where the art had failed heretofore; had enabled persons afflicted with the disease of rupture, to pursue their business and labours without inconvenience; and in fact, its invention had formed a new era in the treatment of that disease; that the instruments sold by the defendant, the one known as Mr. Farr's, and the other as Mr. Hovey's trusses, and by them patented, are clearly infringements of Dr. Hull's patent. The jury returned a verdict for the plaintiff, to the value of the articles sold; and the court, on motion, trebled the damages, according to the statute, with costs. And it was intimated, that any further violation of the plaintiff's patent, would be restrained by injunction.

New London, July 30.

Patent Marine Rail Way.—On Monday last the ship Carrier, of nearly 400 tons, was hauled out by Mr. Miller. This is the largest vessel that has been on the ways, and we were much pleased to observe the facility with which the business was done; not the smallest difficulty presented itself. This invention proves not only to be a great convenience to ship owners, but a saving of expense in repairs. And we are glad to find the business is profitable to the ingenious and indefatigable patentee. It has not, we understand, been in his power to accommodate all applicants, as early as wished, having as yet ways for only two vessels at a time.

The above was received after the subjoined list was in type. (See p. 138.)

List of American Patents granted in June 1828. *With Remarks by the Editor.*

It is intended hereafter to publish the monthly list of patents granted in the United States, in a form calculated to render it much

more useful than the mere catalogue, which has heretofore been given. The subjoined list, for the month of June, will exhibit the Editor's views upon the subject. In the remarks which will be made, the interest of the patentee, and the rights of the public, will be equally considered. Where we think an invention manifests much ingenuity, or promises to be of great utility, we shall say so; where the subject is one of which we have not the means of forming a judgment, or where a statement of the reasons for our opinion would demand too much space, we shall merely offer an outline of the plan proposed; where we are convinced that the invention is not new, or are of opinion that it is without merit, and will not attain the end proposed, our convictions, with the reasons on which they are founded, will be made known.

There are many patents obtained, which, in the opinion of the Editor, ought not to be published until the expiration of the term for which they are granted; and he hopes, at an early day, to see the law so amended as to provide for the sealing up of the kind of patent to which he alludes, and which are technically denominated patents for 'compositions of matter.' Varnishes, compound medicines, compositions for rendering leather, cloth, or other materials water proof, and various others, are of this character. He has known persons possessed of valuable recipes, who would gladly have availed themselves of the benefit of a patent, had it offered them any security; but who have refused to obtain one, because in so doing, their processes were liable to immediate publication, and they were of a nature to be practised in secret with absolute impunity. As the Editor will, hereafter, seek to be restrained from making public such patents, it is his determination, in the interim, to impose upon himself that rule of procedure which he thinks ought to be made absolute.

PATENTS GRANTED IN THE MONTH OF JUNE 1828.

Improvement in water wheels for mills; Abel Greenleaf, of Mexico, Oswego County, New York, June 5.

The plan proposed is to employ two, or more, water wheels, where the undershot kind is used; the second wheel to be acted upon by the water, after it has left the first; the two wheels to be geared together, by an intermediate cog wheel, or to be connected by a band passing over drums upon the wheel shafts, so that, in either case, the motion of the second wheel shall be about one-third less rapid than that of the first; it being estimated that the water will strike it with a power diminished in that proportion. The fall may be divided into two parts, giving such a descent to each, as shall ensure the action to be nearly in this proportion.

Improved machinery for striking bricks, called the "Ohio brick striker;" Ebenezer Duty, and Daniel W. Duty, Geauga County, Ohio, June 7.

This machine is too complex for a short description; its principal parts are a hopper to contain the compost, a lever to force the same down into a mould under the hopper, and a carriage and lever by which the mould is forced under the striker. The machinery is not

clearly explained in the specification, and there is no model deposited to aid us in understanding it. We are told, that the machine was essayed in this city, and not found to answer the expectation of the inventor; but whether this was from a fault in its principle or in its construction, we are not informed.

A machine, or machinery for making barrels, kegs, &c.; Nathaniel Goodall, and Loren Tainter, Watertown, Jefferson County, New York, June 9.

The machinery consists of three parts; the first, for turning the head in a kind of lathe well, adapted for the purpose; the second, is a trough, or box, in which the stave is placed, is forced forward by a follower, and is guided, and made to pass between two knives, one of which forms the rounded, and the other the hollowed side of the stave. The third instrument is a frame in which jointers are made to slide by means of suitable grooves; the staves to be jointed being secured in their proper places by means of an iron frame and cramps. The whole is worked by a shaft set in motion by any sufficient power.

An improved machine for washing, or churning; Daniel Reed, Slaterville, Tompkins County, New York, July 16.

The patents for washing machines are so numerous, and the family likeness in many of them so striking, that mere description will rarely suffice to distinguish one from another. The present machine has a box with sloping sides and a curved bottom with a dasher similar to that of many of its congeners; the dasher is fixed, and the box made to vibrate upon pins, or springs at its upper side. The novelty claimed is the extending the sides of the box upwards, so as nearly to form a triangle, and forming the door on the upper part of the side, instead of on a flat top; by which contrivance it is more effectually closed, and the suds, or cream, more completely prevented from dashing over, than in other similar machines.

An improvement in the bedstead, denominated the "drum sacking bedstead;" Harvey Wilbur, Newburyport, Massachusetts, June 16.

The mode of tightening the sacking proposed by the patentee, is to have a sliding rail, within the head and foot rails of the bedstead; this rail is confined in its place by grooves in the side rails; to the upper edges of these sliding rails the sacking bottom is firmly secured; it is then tightened by screws passing through the head and foot rails, and working in nuts in the sliding rails.

The Editor has lived upwards of half a century, and he has no doubt that he was born upon a bedstead the sacking bottom of which was tightened in this way; he cannot, it is true, remember quite so far back, but among his very early recollections are some half dozen bedsteads in his father's house, so tightened; some of them appearing as old as the Editor now is. Then why has so excellent a plan been discontinued? simply because the screw holes, the grooves, and the edge of the sacking bottom, form so many secure retreats, and breeding places for bugs, as to more than counterbalance any supposed or real advantages over the ordinary pins.

Improvement in the Franklin, or open, stove; William Cowan, Watertown, Jefferson County, New York, June 16.

A triangular tube of cast-iron, open at both ends, is made to pass, lengthwise, through the stove, so as to admit of a free circulation of air through it; this air being warmed by the heated iron is intended to economize the fuel. For an ordinary sized stove the dimensions given for the tube, are 20 inches on the front side, 18 on the back, and 10 inches in width on the top. A valve or slide is proposed near the upper part of the tube so as to regulate the draft by opening or closing the throat.

The cast-iron tube will, we think, be found but little better than the plan of leaving the back of the ordinary Franklin stove exposed to the air of the room, as is frequently done in setting it. Heated tubes of this kind offer but little advantage, excepting a current of cold air, from without the room, is in some way admitted into them; their heated air will otherwise pass out very slowly indeed, and the radiation from the hot surface of iron, being confined within the tube, will scarcely affect the temperature of the air in the room.

Improvement in the mode of manufacturing spirituous liquors from the liquid and sediment usually called still slop; David White, Fredonia, Chatauque County, New York, June 17.

The specification states that the discovery consists in using the liquid sediment, and flour and meal, of grain, and other materials used in distillation, which has been once fermented, and producing a new fermentation, and re-distilling it. The still slop is to be drawn off into clean tubs, cooled down to between 75 and 100° of heat, to have lime, potash, or some other alcali added, to correct, or counteract its acidity; when this is effected and the slop is at a proper temperature, good distillers' yest is to be added, in the ordinary quantity; it is to be allowed to ferment from two to four days, and then distilled. A considerable quantity of spirit will, it is said, be thus obtained.

Improvement called the "armed saw frame," Samuel Sperry, Sparta, Wilson County, Tennessee, June 18.

This proposes to dispense with the fender posts in which the saw-frame usually slides; to attach jointed levers at right angles to the four corners of the saw frame, so as to allow said frame to work up and down in the ordinary manner. Two of the jointed levers may be attached in front of, and two behind the saw, or the whole four may be placed on one side.

This is all that is given, and we confess that we should be a little surprised to see a straight kerf produced by a saw so hung, without something equivalent to the fender posts.

Improvement in the grist mill; Joseph Crail, Warren, Trumbull County, Ohio, June 19.

In this mill the upper stone is to be stationary, and the lower stone to turn; this is not claimed as a novelty; but it is proposed to use very small stones, say of 18 inches diameter, to give a much

more rapid motion than usual, to prevent the heating of the grain by grinding nearer the centre of the stone than has hitherto been done; these, with the manner of preserving a true balance in the under stone, are the improvements gained; it is said that a mill of this kind will do more, and better work, than the ordinary mill, and that with a less expenditure of power.

An engine or machinery for propelling boats, &c. called "Talbot's Atmospheric Propelling Engine;" Edward Allen Talbot, late of Dublin, in Ireland, but now residing in the United States, granted in pursuance of a special act of Congress, June 21.

This will hereafter be described more at large, but as preparations are now making to test the correctness of the principles on which it is founded, and also the force with which it will act, an analysis would at this time be premature. We will, therefore, merely state that by the aid of two atmospheric cylinders, placed horizontally, with their open ends towards the stern of the boat, the pistons of which cylinders are to be operated upon by means of a steam cylinder, or cylinders, it is proposed to obtain a power, acting within the vessel itself, without the aid of paddle wheels, or any substitute therefor, which shall propel a boat with great velocity.

Machinery for making casks, barrels, tubs, &c.; John Hale, Oakam, Worcester County, Massachusetts, June 21.

The staves are first formed by being forced through a machine in which a cutter, or shaver, forms the convex side, whilst a wheel provided with a number of cutters, forms the concave side; the axis of this cutter wheel is in a line with the stave, and of course, the cutters traverse the grain of the stuff to be worked.

The staves are jointed by passing under another cutter wheel, which, instead of being cylindrical, is hollowed from each edge, so as to be of less diameter in the middle than elsewhere; the staves are passed under this so that they are jointed with the required bulge in the middle.

The heads are turned in an apparatus very similar to that described in Goodal & Tainter's patent.

The hoops are shaved, or cut, regularly, by a cutter wheel, similar to that first described, there being a regulating guide to govern their thickness.

Improved mode of fixing the compass on board of vessels; Lemuel Langley, Gosport, Virginia, June 23.

The specification of this patent we have already given in p. 129.

A machine, or machinery called the "dormant balance," for the cure of crooked, or inflected spine, James K. Casey, New York, June 23.

A gentleman, who is no mean judge in such cases, has pronounced this apparatus "beautiful and perfect," and has declared it as his opinion, that, "although the most eminent surgeons have been able only to arrest the progress, this machinery must clearly and safely effect the cure, of crooked spine, and its attendant evils."

We shall, at an early period, give the drawings and description of this apparatus, and therefore need not attempt the latter at present.

For a method of setting stills, boilers and kettles for distilleries, &c.; John Miller and Benton Clemmons, Clemmonsville, Davison County, North Carolina, June 24.

The plan described is to cause the flues to be so constructed that the flame from one fire may be made to circulate around two, three, or more stills, or boilers; the description and drawings are too imperfect to allow us to judge of the merits of the plan.

Improved curriers' knife; Isaac H. Harrington, Penn Yan, Yates County, New York, June 25.

The knife is to be made of the blade of a saw-mill saw, from which it is to be cut cold; a metal bar, embracing each side, is to be firmly rivetted along the middle of the blade, and to the projecting ends of this the handles affixed in the usual manner.

Improvement in the mule for spinning cotton; Thomas Walker, Chester County, Pennsylvania, June 26.

The fly wheel of the mule is to be made so that it can be thrown out of gear, so that the shaft may turn without being acted upon by the wheel. The shaft has two wheels, the one for bringing the carriage out, the other for taking it in. This is to accommodate it to the purpose of dispensing with the ordinary manual labour, and to cause it both to back off and wind up without this aid. It would, obviously, be in vain to attempt to describe movements which must necessarily be extremely complex; we shall probably publish the whole patent.

Improvement in the mode of raising ships, or vessels, and other bodies from the water to repair, and exhibit them to view; John H. Green, Providence, Rhode Island, June 26.

A view of the proposed improvements would demand plates, and descriptions at length; we may, hereafter, take it in hand, but shall wait to hear of the practical operation of the machinery.

A machine called the "domestic spinner;" Edward Penny Adams, Jefferson County, New York, June 27.

This is for spinning wool, in a manner similar to various other machines for domestic use, which have been contrived, to spin several threads at once. The whole machine is described, without a particular specification of what is claimed as new; should we, on comparing it with some others in the patent office, think it possesses any superiority, it shall again be heard of through the medium of the Journal.

A new medicine, being cough drops, for the cure of coughs, colds, consumptions, and other affections of the breast and lungs; Daniel E. Smith, Cornwall, Litchfield County, Connecticut, June 30.

Method of rendering leather water proof; Abraham Straub, Milton, Pennsylvania.

For reasons already stated, we omit the recipes contained in the two last patents.

List of Patents granted in the United States, in April and May, 1828.

FOR INVENTIONS AND IMPROVEMENTS.

In the mode of sawing shingles, called the "Gauge Saw Shingle Machine;" Cheney Read, of Western, Worcester County, Massachusetts, April 2.

In constructing bellows or blowing machines; Elijah Brady, Mount Pleasant, West-chester County, New York, April 3.

In the manufacture of cooper's work; Hiram Waters, Watertown, Jefferson County, New York, April 3.

In an oven for baking over a cooking furnace; Eli Moody, Northfield, Franklin County, Massachusetts, April 5.

In a safety compass lamp; Joseph Feinour and Joseph Feinour, jr., Philadelphia, April 5.

In making terro metallic teeth; Anthony Plantou, Philadelphia, April 5.

In the machine for carding wool; Henry A. Shannon, Columbia County, New York, April 5.

In raising water by vacuum, produced by steam; together with an improvement in mill gearing; Joseph S. Fox, Otto, Cattaragus County, New York, April 5.

In the art of distilling by steam; Benjamin Barr, Strasburg Township, Lancaster County, Pennsylvania, April 5.

In the machine for shearing cloth; Isaac Kellogg and George C. Kellogg, New Hartford, Litchfield County, Connecticut, April 7.

In the mode of transporting carriages, &c. on the inclined planes of rail-ways; Moncure Robinson, Henrico County, Virginia, April 9.

In the thrashing machine; John H. Bennet, of Aurelius, Cayuga County, New York, April 10.

In the fire engine; Ezekiel Daboll, Canaan, Litchfield County, Conn., April 10.

In locking hind wheels of wagons, &c., called "the Franklin lock;" George Diven, of Franklin County, Pennsylvania, April 14.

In the mode of obtaining water; Timothy Davis, Lawrence Township, Dearborn County, Indiana, April 14.

In the mode of manufacturing paper from a marine production, or sea grass, or weed, designated by botanists as "ulva marina;" Hayden Collier, Plymouth County, Massachusetts, now in London, England, April 15.

In the mode of making sugar boxes by machinery; Paul Pearson and John Howe, Alma, Lincoln County, Maine, April 15.

In medicine; Fitzgerald Bird, Hancock, Georgia, April 16.

In the machine called Brown's reel for tanning or handling hides, skins, &c.; William Brown, Frankford, near Philadelphia, April 17.

In the thrashing machine; Calvin Emmons, of New York, April 17.

In the mortising machine; Wm. E. Marsh, Westfield Township, Essex County, New Jersey, April 18.

In the machine for planting and cultivating cotton; Richard Herbert, Williamson County, Tennessee, April 19.

In canal boats; Benjamin Phillips, Philadelphia, April 21.

Improvement on Benjamin F. Brown's standing press frame; Robert Hoe, New York, April 22.

In the revolving hydraulic engine; Asahel Hubbard, Windsor, Vermont, April 22.

In the cogging machine; James A. Post, of Warwick Township, Orange County, New York, April 23.

In the common carriage axle; Daniel W. Phillips and William Maher; the first of Middlebury, and the last of Covington, New York, April 23.

In the churn; Edward Spain, Mount Holly, Burlington County, N. J., April 23.

In the machine for spinning wool, &c.; Arthur Cretchfield, Union Township, Licking County, Ohio, April 24.

A composition for making roofs fire and water proof; Daniel Greer, Pittsburg, Pennsylvania, April 25.

In the lever press, William Linn, Danville, Pittsylvania County, Virginia, April 25.

In the plough; John Deats, Middletown, Bucks County, Pennsylvania, April 26.

In the method of effecting the rotary motion directly from the alternate rectilinear motion of the steam piston, Peter Cooper, New York, April 28.

Improvement, called a portable oven. Francis L. Hedenberg, New York, April 26.

In saw-mills; Isaiah Call, Woodstock, Windsor County, Vermont, April 28.

Improvement, called the oyster platform, John Vreeland, of New York, April 29.

In the printing machine or roller press; George W. Cartwright, Mount Pleasant, West Chester County, New York, April 29.

In the art or process of testing leaden pipes for conveyance of water, Theophilus Packard, Shelburn, Franklin County, Massachusetts, April 29.

In the corn shelling machine; Wm. Hoyt, Vernon, Jenning County, Indiana, April 29.

In the saddle; Alexander Marshall, Pikeland Township, Chester County, Pennsylvania, April 30.

In the mode of communicating power and motion by means of metallic bands; Joseph Eve, of Augusta, Georgia, May 1.

A machine for sawing hoops, basket stuff, stuff for making riddles, window curtains and window blinds; Phinehas Slayton, Lockport, New York, May 1.

On Isaac Leavitt's washing machine; Eli M. Gibbs, Chenango County, New York, May 1.

In the mode of raising and lowering canal boats, without the aid of locks; William Wiard, Avon, Livingston County, New York, May 1.

In the washing machine; Moses P. Parker, Lowville, Lewis County, New York, May 1.

In the spring and valve marine propeller, William Willis, Charleston, South Carolina, May 2.

In the construction of bedsteads; Silas Hyde, Arcadia, Wayne County, New York, May 2.

In the percussion lock for fire arms; Oren Moses, Malone, Franklin County, New York, May 3.

A machine for cutting plugs for waists and decks for shipping. (This patent was issued on the 28th of June, 1826, and re-issued on account of a defective specification, bearing the same date.) Charles Josselyn, New York, May 3.

In the wheelwright's fellow-lathe; John Setton, Pendleton, and James A. Black, Columbia, S. C., May 5.

In the rope reeding machine; Abraham Boring and William W. Jones, Thornville, Perry County, Ohio, May 5.

In the double shooting gun or rifle; Silas Mosher and Noble White, Hamilton, Madison County, New York, May 5.

In percussion locks; Jedediah Caswell, Manlius, Onondago County, New York, May 8.

In the cooking stove; Abraham Fisher, Claremont, Sullivan County, New Hampshire, May 9.

In the water wheel, for propelling machinery, &c.; John Bell, Sycamore Township, Hamilton County, Ohio, May 9.

In the machine for breaking hemp; John S. Van De Graaff, Scott County, Kentucky, May 12.

In the machine for spinning wool and cotton from the roll; William R. M'Call, Vincennes, Knox County, Indiana, May 12.

In making clay pipes; Thomas Wickersham, Newbury, York County, Pennsylvania, May 13.

In tanning and manufacturing hides into leather; Ebenezer Shove and Thomas Hunt, Locke, Cayuga County, New York, May 13.

In the improved method of making glass furniture knobs or handles, for which letters patent of the United States, bearing date the 9th day of September, 1824, were granted unto John P. Bakewell, of Pittsburg; Thomas Bakewell and John P. Bakewell, Pittsburg, Pennsylvania, May 14.

In the boilers of steam engines; James P. Allaire, New York, May 14.

In the machine for cutting leather in the manufacture of shoes; George P. Mitchell, Burlington, New Jersey, May 15.

In the mortar for pounding rice; John Ravenel, Charleston, S. C., May 17.

In distilling spirits from grain and fruit; Jacob Hugus, Hempfield Township, Westmoreland county, Pennsylvania, May 17.

In the machine for cutting pegs; Hezekiah Thurber, town of Painted Post, Steuben county, New York, May 22.

In the mode of making shingles by machinery, called the Howe and Chaffin Shingle Machine; Stilman Howe and Charles Chaffin, Holden, Worcester County, Massachusetts, May 22.

In the saw frame for sawing veneers for cabinet work, and window sash, and window blind stuff, and tenons, May 22.

In the copperplate printing press; Cyrus Durand, New York, May 22.

In preparing straw, hay, or other vegetable substances, for the

manufacture of paper, William Magaw, of Meadville, Crawford County, Pennsylvania, May 22.

In the machine for cutting and forming wooden screws; Stephen Treadwell, Western, Fairfield County, Connecticut, May 22.

In the thrashing machine; Norton Case, North Granville, Licking County, Ohio, May 22.

In the mode or manner of pressing oil out of flaxseed, and other oleaginous seeds; Charles How, Moretown, Washington County, Frederick Brewster, of Colchester, and John Johnson, Chittenden, Burlington County, Vermont, May 24.

In the percussion gun lock; Joseph Lawrence, New Berlin, Chenango County, New York, May 24.

In the washing machine; George Hancock, Maysville, Mason County, Kentucky, May 24.

In the machine for the manufacture of horse shoes; Robert E. Horbart, Pottstown, Montgomery, Pennsylvania, May 24.

In the marine rail-way; John H. Greene, Providence, Rhode Island, May 26.

Improvement, being an oil boiler, or bain marie of oil, for use in refining sugar, and for other purposes, William Augustus Archbald, of New York, May 29.

For a double boiler and other apparatus for refining sugar, and for other purposes; William Augustus Archbald, of New York, May 29.

In the filtering apparatus, to be used in sugar refining, and for clarifying liquids in general; William Augustus Archbald, New York, May 29.

In the mill for breaking and grinding tanners' bark, and corn in the ear; John Montgomery, Sangerfield, Oneida County, New York, May 29.

In the gun lock; Nathaniel Saltonstall, New London, Connecticut, May 29.

In the cylindrical printing press; Charles G. Williams, New York, May 29.

In the mode of manufacturing hat bodies, by machinery, at one operation; George L. Thatcher, of Brooklyn, King's County, New York, May 31.

In machinery for propelling ships and other vessels; Anthony Hermange, Baltimore, May 31.

LIST OF ENGLISH PATENTS.

List of patents for New Inventions, which passed the Great Seal, in England, from January 26, to April 19, 1828.

To John Weiss, surgical instrument maker; for improvements on instruments for bleeding horses, and other animals—26th January.

To Augustus Applegath, printer; for improvements in block printing—26th January.

To Donald Currie; for his method of preserving grain, and other vegetable and animal substances, and liquids—31st January.

To William Nairn, mason; for his improved method or methods of

propelling vessels through or on the water, by the aid of steam, or other mechanical force—5th February.

To Caleb Hitch, brick-maker, for his having invented or found out an improved wall for building purposes—21st February.

To George Dickinson, paper manufacturer; for his invention of an improvement or improvements in making paper by machinery—21st February.

To Angelo Benedetto Ventura, professor of music; for his having invented certain improvements on the harp, lute, and Spanish guitar—21st February.

To Thomas Otway, iron master; for his new invented expedient for stopping horses, when running away with riders or in carriages—21st February.

To David Bently, bleacher; for his having invented or found out an improved method of bleaching and finishing linen or cotton yarn and goods—21st February.

To William Brunton, civil engineer, for his having invented certain improvements on furnaces for the calcination, sublimation or evaporation of ores, metals, and other substances—21st February.

To John Levers, machine-maker; for his having invented or found out certain improvements in machinery for the manufacture of bobbin-net lace—3d March.

To William Poronall, weaver; for his new invented improvements in making healds for weaving purposes—6th March.

To Barnard Henry Brook, civil engineer, for his new invented improvements in the construction and setting of ovens and retorts for carbonizing coal for the use of gas-works—6th March.

To William Roger, lieutenant in our royal navy; for his invention of certain improvements on anchors—13th March.

To Robert Griffith Jones, in consequence of a communication made to him by a certain foreigner residing abroad, for an invention of a method of cementing China, and certain other compositions, which he denominates letnophanic, translucid, or opaque china—13th March.

To George Scholefield, mechanic; for his invention of certain improvements in, or additions to looms for the purpose of weaving woollen, linen, cotton, silk, and other cloths—13th March.

To Nathan Gough, civil engineer; for his having invented or found out an improved method of propelling carriages or vessels by steam or other power—20th March.

To Samuel Cligg, civil engineer; for his invention of certain improvements in the construction of steam engines, and steam boilers, and generators—20th March.

To Jane Bentley Lowrey, straw hat manufacturer; for certain improvements in the manufactory of hats and bonnets—25th March.

To Edward Cowper, gentleman; for certain improvements in cutting paper—26th March.

To Ferdinand de Fourville, merchant; for certain improvements in filtering apparatus—26th March.

To Thomas Lawes, lace manufacturer; for improved thread, to be used in the manufacture of the article commonly called bobbin-net lace—29th March.

To Henry Marriott, ironmonger, and Augustus Siebe, machinists; for improvements in hydraulic machines—29th March.

To Peter Taylor, flax dresser, being one of the people called quakers; for certain improvements in machinery, for hackling, dressing, or combing flax, hemp, tow, and other fibrous materials—29th March.

To John Davis, sugar refiner; for an improvement in boiling or evaporating solutions of sugar and other liquids—29th March.

To Charles Harsleben, Esq.; for certain improvements in machinery to be used in navigation, chiefly applicable to the propelling of ships, and other floating bodies, and which improvements are also applicable to other purposes—3d April.

To Lemuel Wellman Wright, engineer; for improvements in the construction of wheel carriages, and in the machinery employed for propelling, drawing, or moving wheel carriages—15th April.

To John Gottlieb Ulrich, chronometer maker; for improvements in chronometers—19th April.

NOTICES.

THE ROMANCE OF THE RATTLESNAKE.

Just as the Editor was leaving Philadelphia for Washington, he was pressed for 'more copy' by his printer, and hastily marked some articles for insertion, among which were '*Notes on the Rattlesnake. By* JOHN JAMES AUDIBON, F. R. S. E., M. W. S., &c. Time did not admit of reading the article, but it was seen that the writer professed to offer the 'fruits of many years' observation, in countries where snakes abound.' This, with his titles, and the bold and splendid assurances which we had seen respecting the publication of his works, served as a password to his tissue of falsehoods, which would have been expunged from the proof, but for absence from the press.

We had determined to publish a notice like the foregoing, when we received a note from a scientific friend, whose remarks are, at once, so pointed, and correct, and so fully express our own ideas upon the subject, that we gladly adopt, and insert them.

"It is a tissue of the grossest falsehoods ever attempted to be palmed upon the credulity of mankind, and it is a pity that any thing like countenance should be given to it, by republishing it in a respectable Journal. The romances of Audibon, rival those of Munchausen, Mandeville, or even Mendez de Pinto, in the total want of truth, however short they may fall of them in the amusement they afford."

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W. C. on the adhesion of disks, requires an engraving. He shall appear in our next.